4 AFFECTED ENVIRONMENT, EFFECTS AND MITIGATIONS

4.1 INTRODUCTION AND IMPACT ANALYSIS

The environmental setting of the Vegetation Treatment Program (VTP) is diverse; from conifer and hardwood forest and woodlands in the mountain and coastal areas, to shrub and herbaceous rangelands in the south coast, north interior and central valley, to desert habitats in the southeast (FRAP, 2010). Covering such an extensive and heterogeneous region, VTP projects will reflect the needs of the vegetation at the local and regional levels.

Individuals, laws and public agencies through ownership, management direction, and interaction with private landowners play a strong role in shaping natural systems. Nearly all VTP projects will occur on private ownership. Federal management activities influence the environmental setting on neighboring forest and rangelands adjacent to those under the jurisdiction of CAL FIRE. Approximately 37 million acres are within CAL FIRE's fire protection and fuels treatment jurisdiction. Table 4.1-1 shows the area of land cover type by owner group. These lands are managed for a variety of purposes, including recreation, open space, and ecological services and goods.

Table 4.1-1 Area of land cover type by owner group (acres in thousands) (FRAP, 2010).

Vegetation Type	Private	USFS	BLM	NPS	Other Public	NGO	Total*
Conifer Forest	6,653	10,762	345	1,106	434	34	19,335
Hardwood Forest	2,828	1,305	194	104	151	12	4,594
Conifer Woodland	466	989	469	317	137	21	2,399
Hardwood Woodland	4,296	284	193	19	456	45	5,292
Shrub	4,842	5,806	2,353	282	1,180	60	14,522
Herbaceous**	9,525	376	433	82	831	159	11,407
Desert	3,540	137	10,450	4,772	4,325	27	23,251
Total	**32,150**	**19,659**	**14,437**	**6,682**	**7,514**	**358**	**80,800**

*Totals may not add up due to rounding **Includes wetlands

A multitude of factors in the wildland fire environment contribute to fire behavior. One of the most important factors that can influence fire behavior is the fuel type. Fuel type represents an identifiable association of fuel elements of distinctive species, form, size, arrangement, or other characteristics that will cause resistance to control under specified weather conditions (NWCG, 2014). While California is home to a tremendous range of fuel types, which can be condensed into three main groups based on the sufficiently distinct fire behavior each group exhibits (Bishop, 2007). These groups can be classified as **Tree-dominated**, **Grass-dominated**, and **Shrub-dominated** vegetative formations. Table 2.2-1 identifies the associated vegetative subtypes by these three dominate vegetation formations. Figure 2.2-2 illustrates how these three groups lay across the California landscape within the SRA.

As previously stated in Chapter 2, there is a critical need for widespread fuel reduction across the West. Fuels come in various shapes, sizes, and arrangements. There are live and dead fuels, herb and shrub fuels, litter, twigs and branches, ladder fuels (small trees), and canopy fuels (larger trees) (Agee and Skinner 2005). Fuels management at the landscape scale is focused on treating fuels to help suppression forces more easily contain fire, reduce the area burned by high-intensity fire, or reduce the risk of fire ignitions. This is accomplished by modifying fire behavior through strategic placement and arrangement of fuel reduction treatments on the landscape (Finney and Cohen 2003; Graham et al. 2004). To address the fuel conditions throughout the SRA, projects conducted under this Program EIR have been organized into three general treatments or project types: **Wildland-Urban Interface**, **Ecological Restoration** and **Fuel Breaks**

4.1.1 LAND MANAGEMENT REGULATION

LAWS AND PUBLIC AGENCIES

The body of laws regulating California's forest and rangelands is complex. At least 50 federal laws, 20 executive orders (or other federal policy directives) and nearly 40 state laws provide the legal framework (FRAP, 2003). A number of county, state and federal agencies are charged with enforcing statutes and regulating resource use and extraction activities on these lands. The result is an often overlapping system of jurisdictions and regulations of land management, which can make it difficult for private land managers to meet all standards and laws and develop economically. Federally managed lands come under the jurisdiction of federal laws and regulations, whereas management of private and state-controlled land needs to comply with state, county and local laws and regulations, as well as some federal statutes.

FEDERAL AGENCIES

The federal agencies managing substantial forest and rangeland areas of California are the U.S. Department of Agriculture's Forest Service, the U.S. Department of the

Interior's Bureau of Land Management (BLM), National Park Service (NPS), Bureau of Indian Affairs (BIA), and the Department of Defense (DoD) (Table 4.1-2).

Land management activities on California's 18 national forests are guided by Land and Resource Management Plans ("forest plans") developed by and for each forest in compliance with the Forest and Rangeland Renewable Resources Planning Act (RPA) and the National Forest Management Act (NFMA), as well as the National Environmental Protection Act (NEPA) and all other federal and state laws that apply. Forest plans are the official documents that describe the full spectrum of program-level management activities scheduled to occur in that national forest's jurisdiction within the planning cycle. These include timber harvest levels and locations, any road building and/or removal, forest wildfire fuels mitigations, invasive weed control, livestock grazing allotments, recreational facilities maintenance and improvement, etc. Forest plans are normally updated on a 10-year cycle.

Section 202 of the Federal Land Policy Management Act (FLPMA), enacted in 2002, provides the principles that guide BLM land management plans and activities. The BLM employs an ad hoc approach to proposing and implementing Resource Management Plans (RMPs) governing its use of the 262 million acres it administers in the western United States. These plans describe lands that can be used for livestock grazing and the parameters under which grazing can occur. In mid-2006, BLM issued amended rules regarding aspects of its rangeland program (United States Bureau of Land Management et al., 2006).

The National Park Service (NPS) has 23 parks, monuments, recreation areas, and seashores across all regions of California. Lands in these parks cover a wide variety of forest and range ecosystems. The National Park Service manages lands primarily to provide recreational opportunities and ecological services. Some parks have plans which detail specific resource management activities, such as Yosemite National Park's recent Fire Management Plan (2009). As timber extraction and grazing (and related activities) are prohibited in National Parks, only those NPS plans related to vegetation management and fuels mitigation have bearing on the proposed VTP.

STATE AGENCIES

The California Department of Fish and Wildlife (CDFW) manages over 600,000 acres of land with forest and rangeland settings and includes bighorn sheep habitat, deer habitat, grassland/upland habitats, special habitats, and threatened and endangered habitats. These lands are managed primarily for habitat, recreation, and ecological services. Just over half of the lands managed by California Department of Parks and Recreation can be considered to have settings associated with forest and rangeland ecosystems. The California Department of Forestry and Fire Protection (CAL FIRE) manages eight demonstration forests covering over 71,000 acres. These are primarily forestland habitats, but do contain some range. State forests are managed for a variety of purposes. Conservancies covering the largest land acreage are the Sierra Nevada Conservancy, Coachella Mountains Conservancy, and San Gabriel and Lower Los Angeles Rivers and Mountains Conservancy. The main focuses of all these conservancies are to protect, preserve, and enhance natural habitat corridors while providing public access and recreational opportunities (FRAP, 2003).

LOCAL AGENCIES

A portion of these lands, especially city parks, are developed settings with irrigated grass and other developed facilities. Wildland local parks are predominately found in the Bay/Delta, Central Coast, and South Coast bioregions and are particularly prevalent in areas adjacent to the Bay Area, Los Angeles, Orange, and San Diego County urban areas. Local parks with wildland settings and forest and rangeland vegetation are only a part of the total acres of local parks listed (Table 4.1-2). Local park acreage is considerably less extensive in the more rural regions of California that already have large areas of federal land.

Table 4.1-2 California Land Management (FRAP, 2011).

Federal	Acres
Forest Service	20,764,000
Bureau of Land Management	15,159,000
National Park Service	7,621,000
Bureau of Indian Affairs	438,000
Department of Defense	3,995,000
State	
Dept. of Parks and Recreation	1,339,000
Dept. of Forestry and Fire Protection	72,000
Dept. of Fish and Game	1,148,958
Local Parks	
City Parks	693,000
County Parks	316,000
District Parks	558,000
Conservancies	
Baldwin Hills Conservancy	1,200
Tahoe Conservancy	148,000
Coachella Valley Mountains Conservancy	2,000
San Joaquin River Conservancy	5,900
Santa Monica Mountains Conservancy	9,000
State Coastal Conservancy	1,000
San Diego River Conservancy	300,000
Sierra Nevada Conservancy	25,000,000
San Gabriel and Lower Los Angeles Rivers and Mountains Conservancy	569,000

4.1.2 ANALYSIS INTRODUCTION

Environmental impacts are a function of both the extent and the intensity of the effects. *Intensity* of effects refers to the degree of change in biological and physical characteristics that are likely to result from carrying out the treatment. *Extent* of effects refers to the quantity of acres treated and their distribution across the landscape.

As previously described in Chapters 2 and 3, treatments would be applied across each bioregion by willing landowners implementing practices designed to accomplish one or more of the goals outlined in Section 2.2. An individual treatment by itself or multiple treatments might take place all in one year, or might be spread out over several years. Most treatments would be applied in order to achieve desired future conditions such as reducing the severity and extent of wildland fire. In addition, in every bioregion, treatments would tend to be focused on a subset of the purpose and goals. Table 4.1-3 illustrates how a project may focus on a subset of the goals in chapter 2.2.

For analysis purposes, the number of acres treated yearly is assumed to be 1/10th of the ten-year totals shown in Chapter 2. However, the actual acres treated annually in any bioregion will vary substantially year-to-year based on several factors, such as availability of cooperating landowners, funding, and access constraints. In addition, it is assumed that the 10-year total acreage treated would never all occur within one year or any one bioregion, but would be distributed across several years and several bioregions. Finally, if the acreage being treated in a bioregion exceeded 110% of the yearly average, then further analysis would be required at the project level to ensure that significant effects did not take place.

Table 4.1-3 Example of Project goals within each Bioregion

Bioregion	Examples of Project Objectives
North Coast/Klamath	Maintain/ enhance forest and rangeland resources through periodic low intensity treatments (emphasis on Goal 4).
Modoc	Reduce noxious weeds and invasive plants and improve browse and forage for wildlife and domestic stock, also maintain/ enhance forest and range land resources (emphasis on Goal 4).
Sacramento Valley	Maintain/improve air quality through vegetation treatments that reduce the severity of large, uncontrolled fires, also restore the natural range of fire-adapted plant communities through periodic low intensity vegetation treatments (emphasis on Goals 2, 3 & 4).
Sierra	Reduce effects to watersheds from wildfire by varying the distribution of vegetation treatments within and across watersheds, also modify wildfire behavior to reduce losses to life and property and reduce the severity of wildfires by altering the volume/continuity of wildland fuels (emphasis on Goals 1, 3 & 4).
Bay Area	Reduce the severity of wildfires by altering the volume/continuity of wildland fuels, modify wildfire behavior to reduce losses to life and property and reduce the severity of wildfires by altering the volume/continuity of wildland fuels, and restore the natural range of fire-adapted plant communities through periodic low intensity vegetation treatments (emphasis on Goals 1-5).
San Joaquin	Maintain/improve air quality through vegetation treatments that reduce the severity of large, uncontrolled fires and modify wildfire behavior to reduce losses to life and property, and reduce the severity of wildfires by altering the volume/continuity of wildland fuels (emphasis on Goals 1 & 2).
Mojave	Reduce noxious weeds and invasive plants and improve browse and forage for wildlife and domestic stock, also maintain/ enhance forest and rangeland resources (emphasis on Goal 4).
Central Coast	Modify wildfire behavior to reduce losses to life and property, reduce the severity of wildfires by altering the volume/continuity of wildland fuels, and restore the natural range of fire-adapted plant communities through periodic low intensity vegetation treatments (emphasis on Goals 1, 2 & 4)
Colorado Desert	Reduce noxious weeds and invasive plants and improve browse and forage for wildlife and domestic stock, also maintain/enhance forest and rangeland resource (emphasis on Goal 4).
South Coast	Modify wildfire behavior to reduce losses to life and property, reduce the severity of wildfires by altering the volume/continuity of wildland fuels, and restore the natural range of fire-adapted plant communities through periodic low intensity vegetation treatments (emphasis on Goals 1, 2 & 4)

4.1.3 MAJOR TREE, BRUSH & GRASS VEGETATION FORMATION REVIEW

This section provides more detail of the discussion in Chapter 2.2 and covers an analytical review of the three vegetation formations in greater detail.

4.1.3.1 Life History Features for Tree-dominated Subtypes

Hardwood forests are California-wide within the Mediterranean climate zone, largely in foothill areas of the Coast Range and Sierra Nevada. The forest overstory is typically dominated by deciduous hardwood species that result in an herbaceous surface fuel complex dominating fuel/fire behavior. The typical regime is frequent, low-severity fire that likely exerts positive influence on overstory productivity and canopy resilience to fire damage. The WHR vegetation classes compiled under the hardwood forest subtype for California include montane riparian, aspen, montane hardwood, hardwood, eucalyptus, and valley foothill riparian (Table 4.1-4).

Table 4.1-4 Hardwood forest WHR types representative fuel models, and median fire return intervals (FRI) in State Responsibility Areas (SRA) (*Anderson, 1982)(Scott and Burgan, 2005)**

WHR Type	Acres	Anderson* Fuel Model	Scott & Burgan Fuel Model**	Median FRI (Years)
Aspen	4,492	8	TL2	20
Eucalyptus	6,469	9	TL9	5
Montane Hardwood	2,805,625	9	TL6	13
Montane Riparian	99,975	8	TL2	13
Valley Foothill Riparian	41,074	9	TL6	12
Total Acres	**2,957,634**			

The long-needled conifer subtype includes vegetative formations widely distributed throughout California. Where stands are relatively dense and sufficient fuels are available, the typical fire regime includes frequent (less than 15 years), low severity fires. The WHR vegetation classes compiled under the long-needled conifer subtype for California include Sierran mixed-conifer, montane hardwood-conifer, Ponderosa pine, eastside pine, Klamath mixed conifer, Jeffrey pine, and general (undetermined/unclassified) conifer (Table 4.1-5).

Table 4.1-5 Long-needled conifer WHR types in State Responsibility Areas (SRA)

WHR Type	Acres	Anderson Fuel Model	Scott & Burgan Fuel Model	Median FRI (Years)
Eastside Pine	427,895	9	TL8	7
Jeffrey Pine	40,770	9	TL8	7
Klamath Mixed Conifer	340,203	9	TL8	12
Montane Hardwood-Conifer	730,182	9	TL8	13
Ponderosa Pine	425,933	9	TL8	7
Sierran Mixed Conifer	1,631,598	9	TL8	9
Unknown Conifer Type	85,389	9	TL8	12
Total Acres	**3,681,971**			

The short-needled conifer subtype includes most true-fir formations and short-needled pines. Disturbance patterns for this subtype range from frequent, low severity fires like that of the white fir, to very infrequent high severity fires that are typical of higher elevation lodgepole pine stands. The WHR vegetation classes compiled under the short-needled conifer subtype for California include Douglas-fir, Redwood, red fir, closed-cone pine/cypress, lodgepole pine, subalpine conifer, juniper, Pinyon-juniper, and white fir (Table 4.1-6).

Table 4.1-6 Short-needled conifer WHR types in State Responsibility Areas (SRA)

WHR Type	Acres	Anderson Fuel Model	Scott & Burgan Fuel Model	Median FRI (Years)
Closed-Cone Pine-Cypress	65,022	9	TL2	59
Douglas-Fir	1,350,358	8	TL3	12
Juniper	359,842	8	TL4	77
Lodgepole Pine	31,139	8	TL3	36
Pinyon-Juniper	123,294	8	TL4	94
Red Fir	104,445	8	TL3	33
Redwood	1,228,529	8	TL2	15
Subalpine Conifer	16,604	8	TL1	132
White Fir	156,134	10	TL5	12
Total Acres	**3,435,366**			

4.1.3.2 Life History Features for Grass-dominated Subtypes

The grass-dominated subtypes can be divided into two general categories. Plants that complete their entire life cycle within a single growing season are classified as an annual while perennials may persist for many growing seasons. These subtypes include a diversity of dominant cover types composed of annual and perennial grass and forb species. Grasslands are also commonly associated with oak woodlands. The California grassland is extremely variable both spatially and temporally. Fire spread is governed by the fine, very porous, and continuous herbaceous fuels that have cured or are nearly cured. Fires are predominantly surface fires that move rapidly through the cured grass and associated material. Surface fires, under typical conditions, do not transition into the crowns of associated trees. The WHR vegetation classes compiled for both annual and perennial grassland subtypes for California include annual grassland, blue oak-foothill pine, valley oak woodland, blue oak woodland, coastal oak woodland, and perennial grassland (Table 4.1-7).

Table 4.1-7 Annual and Perennial Grassland WHR types in State Responsibility Areas (SRA)

WHR Type	Acres	Anderson Fuel Model	Scott & Burgan Fuel Model	Median FRI (Years)
Annual Grassland	7,976,910	1	GR4	3
Blue Oak-Foothill Pine	766,067	2	GR4	12
Blue Oak Woodland	2,412,571	2	GR4	12
Coastal Oak Woodland	835,638	2	GR4	12
Perennial Grassland	27,682	3	GR6	3
Valley Oak Woodland	116,305	2	GR4	12
Total Acres	**12,135,172**			

Fire transitions easily into and out of grass dominated plant communities (Mutch, 1970). Much of California grassland has been protected from burning by fire suppression policies and heavy grazing. Hence, where remnant perennial grasslands remain, properly timed fire and grazing can improve seedling establishment and survival and can increase the basal area of established native plants. However, the application of prescribed fire and range management in the absence of an established perennial grassland seed source will not result in a greater distribution of perennial establishment (George et al., 1992).

4.1.3.3 Life History Features for Shrub-dominated Subtypes

The capacity of species to recover from fire is assumed to be based on two types of regeneration – from buried seeds (the seed bank) and from root sprouting or sprouting from lower stems that have survived the fire (the bud bank). The regeneration capacity from the seed and bud banks is assumed to be relatively short, 1-2 years, during which the potential of stored seed germination and re-sprouting is largely expended. One feature not included in this scheme is the distinction between species that continue to produce new sprouts—though not as vigorously as after fire, but sufficient to rejuvenate their canopies—and species with a much reduced capacity for continual recruitment of new stems from sprouts. This is not a dichotomous condition but a continuum. At one extreme are species of *Cercocarpus* which develop into individuals with a whole range of stem ages and, in old stands, an accumulation of large dead stems. At the other are some obligate seeding *Arctostaphylos* species which rarely produce new sprouts.

Another continuum that approaches a dichotomy is the capacity to establish seedlings that can eventually recruit to the canopy in unburned vegetation after the initial post-fire phase is past. A few chaparral species do this readily (*Prunus ilicifolia, Rhamnus* spp.) but most do not. Many drought deciduous species of the coastal sage scrub have this ability. Species that are able to expand their populations from seed dispersal post-fire can sustain plant cover without the intervention of fire. It should be stressed that this is a largely hypothetical risk, as will be explained below.

Table 4.1-8 General Shrubland WHR types in State Responsibility Areas (SRA)

WHR Type	Acres	Anderson Fuel Model	Scott & Burgan Fuel Model	Median FRI (Years)
Bitterbrush	77,815	5	SH2	53
Chamise-Redshank Chaparral	698,784	6	SH6	59
Coastal Scrub	1,034,197	5	SH2	100
Low Sage	20,903	5	SH2	53
Mixed Chaparral	1,800,411	4	SH7	59
Montane Chaparral	356,989	4	SH5	24
Sagebrush	870,261	5	SH7	41
Total Acres	**4,859,360**			

Table 4.1-9 Desert Shrubland WHR types in State Responsibility Areas (SRA)

WHR Type	Acres	Anderson Fuel Model	Scott & Burgan Fuel Model	Median FRI (Years)
Alkali Desert Scrub	235,386	5	SH2	610
Desert Scrub	658,612	4	SH2	610
Desert Succulent Scrub	28,328	5	SH1	610
Joshua Tree	10,341	5	TU5	610
Total Acres	**932,667**			

4.1.3.3.1 HOW THE FIRE ECOLOGY OF SOUTHERN SHRUB ECOSYSTEMS DIFFERS FROM THAT OF FOREST IN REGARDS TO FIRE

Shrublands have varied fire frequencies. Resilience is realized differently among shrub species and can be simplistically divided into vigorous post-fire sprouters, weak post-fire sprouters, obligate seeders, and other. The vigorous sprouting species are of two types, those that also establish seedlings in abundance post fire (e.g., *Adnenostoma fasciculatum*) and the much more numerous group of species that do not (e.g. *Heteromeles arbutifolia*). The weak re-sprouters include many coastal sage scrub drought deciduous species such as *Salvia* spp. and *Artemisia californica*. These species also re-establish by seed and many can recruit new individuals to the canopy in the periods between fire if suitable gaps appear or are present. The 'other' category is included because there are possibilities not covered in the simple scheme as laid out here. Finally, it needs to be emphasized that there is geographic variation in fire response. Some species will sprout readily in some areas and not in others.

Taking all of this together, it can be said that virtually all shrub ecosystems will recover well from wildfire, but the transition of species is not always a certainty. To clarify the management-relevant risks Zedler (1995) proposed the concepts of "senescence risk" and "immaturity risk," defined as follows:

Senescence risk is the risk that species populations may be greatly reduced or goes locally extinct because of death or a loss of vigor of individual plants resulting from extreme age. Stands facing senescence risk will change significantly when burned because of the inability of formerly dominant species to regenerate.

Immaturity risk is the risk that species will be burned before they have accumulated enough reserves of seeds or stored energy for re-sprouting at the time of fire. This risk is real, as has been demonstrated not only in California (e.g., Sampson 1944), but also in other Mediterranean climate regions.

In the past, some managers have felt strongly that because of the obvious capacity of some shrub systems to recover from fire, such systems needed frequent fire to remain "healthy." Since this belief aligned with the objective of reducing fuel loads and "flammability," the idea that chaparral needed to have prescribed fire frequently applied was widely accepted. Over time, instances of the loss or significant reduction of species that were victims of immaturity risk began to accumulate. In addition, the study of chaparral ecosystems began to reveal that chaparral, in addition to being resilient to fire at shorter intervals, was also resilient to fire at long intervals (Sampson, 1944; Horton and Kraebel, 1955). Contrary to ideas that chaparral was subject to significant senescence, it was observed that the accumulation of dead and dying plants was part of a normal cycle of post fire stand development. Though in theory it might be possible for chaparral to become "senescent" in the sense defined above, it was evident that this would not occur for many decades and at ages far in excess of those that were the target for fuel reduction strategies.

4.1.3.3.2 CHAPARRAL AND FIRE

In some forested types, actions that reduce the probability of severe fires can be more or less aligned with the restoration of a more natural fire regime. That is, the asymmetry between human needs and ecological needs can be acceptably small. The desired management regime of the ponderosa pine, Jeffrey pine, and Sierran mixed conifer forest types can fall into this category. There is good reason to believe that past management actions and non-action has resulted in fuel structures that are significantly different from those that existed historically, with the result that fires are larger and especially more severe and damaging to the system than those that occurred historically. This may justify actions to modify fuel structure to permit management burning to be used to simulate the historical pattern.

But this "fuel reduction model," which aims at the restoration of a more natural fuel structure and a more natural fire regime through fuel manipulations and the imposition of management burns, does not apply to southern chaparral and coastal sage scrub. These are vegetation types that might be characterized as being "obligate crown fire systems." That is, if they burn, they burn in an intense crown fire that kills most or all of the above-ground plant tissue. Because of this, unmanaged chaparral is seen as a serious hazard to humans and their property. Given past and current urban development policy and the fact that communities are stretching further into the wildlands, chaparral wildfires have resulted in significant damage to property and loss of life. Thus from a strict "human hazard reduction" viewpoint, management to reduce the amount of burnable biomass is said to be justified in many instances, especially within well-developed urban interface areas.

But in chaparral landscapes the discrepancy between what is best for the ecological integrity of the chaparral and what is best to minimize hazards to humans is very large. The best available information strongly suggests that fire return intervals for chaparral are much longer than many have believed. The Van de Water and Safford (2011) review of fire frequency estimates for California vegetation types supports the idea that chaparral is an infrequent fire system. The mean and median fire return intervals for the composite type "chaparral and serotinal conifers" are 55 and 59 years respectively. The mean minimum is 30 years. These numbers are significantly greater than those that have traditionally been cited. A widely held misconception is that the typical fire return interval is between 25-30 years (Dodge, 1970), when in fact that is on the low end of the Van de Water and Safford (2011) estimates. This leads to the conclusion that in its present state, and in consideration of the substantial pressure from human-caused or human-related fire, chaparral does not need more fire, it needs less (Safford and Van de Water, 2014). However, new scientific information could modify that conclusion in the future as it becomes available. For example tree-ring data collected by Lombardo *et al*. (2009) in bigcone Douglas-fir stands surrounded by chaparral indicate that both extensive and smaller fires were present in historical time.

Summarizing the important features of chaparral with respect to fire:

- Mature chaparral has, in general, a continuous canopy capable of supporting very large, high-intensity fires which are difficult to control. If chaparral has not evolved to burn as research suggests, it appears it does allow for rapid rates of fire spread under certain environmental condition.
- Chaparral rarely experiences surface fire. If fire is burning beneath the shrubs, ignition of the canopy is almost certain to result. Thus there is no possibility of instituting frequent “light” management burns to reduce the fuel in a manner analogous to what is done in certain forest types.
- After fire the fuel loads of chaparral drops precipitously. Thus very young stands (meaning stands in the early stages of recovery after fire) are significantly less likely to propagate fires. But this period of significantly reduced propensity to burn is brief (less than 10 years) relative to the 50 year median time to the next fire.
- If very young stands do burn, the obligate seeding species face significant risk of dramatic population decline because of a lack of seeds.
- Immaturity risk aside, burning chaparral at high frequency opens up stands, and if continued over long periods will degrade chaparral and foster the invasion of undesirable aliens, specifically the annual grasses.
- In some cases the increase in light fuels following fire-induced degradation can result in shorter intervals between fires, furthering the rate of degradation.

Though it may be the case that completely removing fire from the landscape could cause significant and perhaps undesirable shifts in southern chaparral communities (i.e. quantity and distribution), it would likely require a number of decades before the shift became a practical concern. Lightning, human accidents, and arson, combined with drought intervals, all appear to provide numerous opportunities for fire to visit southern California chaparral systems. Burning in southern chaparral systems, to enhance ecological function, at intervals shorter than natural fire return frequencies, may lead to adverse ecological results.

On private range lands there is much less obligation to preserve native systems, and burning at high rates to convert shrubs to systems with a higher proportion of grass can perhaps be economically justified. There are cases where aggressive burning that reduces shrub cover can have adverse ecological consequences. The most likely negative effect will be on steep erodible slopes where shrub removal can destabilize slopes. Another example of fuel reduction in shrubs includes projects that might contribute to a landscape level plan for improving access and control in the event of a wildfire.

4.1.3.3.3 OTHER SHRUB SPECIES AND FIRE

NORTHERN CHAPARRAL

The management of shrublands in the northern areas of the state does not necessarily hold the same concerns as those in the southern portion of the state (Modoc Bioregion verses the South Coast bioregion). Vegetation type-conversion here is of far less concern given the observed recovery of these ecosystems post-fire. Northern shrublands also do not necessarily require a reduction in fire on the landscape as the southern ecosystems do (Safford and Van de Water, 2014), and do not have the high number of human-caused fires. For these reasons, an ecological rationale for fuel treatments in shrub dominated and co-dominated ecosystems in northern California can be used.

COASTAL SAGE SCRUB TYPES

Coastal sage scrub (CSS) is a general term to describe shrub vegetation that is generally of lower stature (but with exceptions – such as *Malosma laurina*) and with a much higher occurrence of facultatively drought deciduous species, for example *Salvia* spp., *Eriogonum fasciculatum*, and *Artemisia californica*. Further north, *Baccharis pilularis* is a common species that fits within CSS in the broad sense. In general, the response of coastal sage scrub is similar to that of other chaparral in that burned CSS will quickly recover after fire undergoing the same kind of so-called “auto successional” process (Hanes, 1971) in which species present before a fire are predominately the species present after the fire. This species composition is because of re-sprouting and germination from a seed bank. Unlike most evergreen chaparral species, however, many of the non-evergreens are capable of expanding and rejuvenating their populations without fire. Seedlings will germinate and, when vegetation openings are present, can survive to maturity. This same ability makes CSS species more invasive than most other chaparral species. This process has blurred the patterns of distribution of CSS from its historical range. For example, disturbed roadsides through chaparral landscapes will often be dominated by, e.g. *Eriogonum fasciculatum* and other opportunistic species.

The prescription and cautions applying to chaparral mostly also apply to CSS. Like chaparral, CSS does not “require” frequent fire to remain “healthy.” In fact, in the Van de

Water and Safford (2011) paper CSS is assigned a median fire return of 100 years, about double the fire return interval of chaparral. Thus the cautions about prescribed burning apply equally to CSS.

SAGEBRUSH STEPPE AND RELATED TYPES

Sagebrush dominated vegetation occurs in mountain valleys and in the northeast portion of California within the Great Basin biotic province. Van de Water and Safford (2011) report median fire return intervals in the 30 and 40 year cycles. Despite the relatively short return intervals, sagebrush vegetation is not as clearly fire adapted as the vigorously sprouting and reseeding chaparral species. Current published literature is not clear if fire used as a management tool actually benefits sagebrush systems. This leads to a general recommendation to avoid imposing burning treatments unless there are compelling reasons. One of these reasons may exist where sagebrush forms an understory in some forest types where low severity fire regimes are known to exist.

4.1.3.3.4 Guidelines for Projects Located Outside the WUI within Southern California Shrub-dominated Subtypes

Projects that are not deemed to be necessary for the defense of critical infrastructure within the WUI that treat vegetation within the shrub-dominated subtype in San Diego, Imperial, Riverside, Orange, Los Angeles, Ventura, Santa Barbara, Kern, and San Bernardino counties will:

1) Be designed to prevent vegetation type conversion to non-native species.
2) Not take place in vegetation that has not reached the age of median fire return intervals.
3) Not re-enter treatment areas for maintenance in an interval shorter than the median fire return interval outside of the wildland urban interface and excluding fuel break maintenance.
4) Not take place in old-growth chaparral without consultation with the Department of Fish and Wildlife and the California Native Plant Society.
5) Take into account the local aesthetics, wildlife, and recreational uses of the Shrub-dominated Subtype during the planning and implementation of the project.
6) During the project planning phase provide a public workshop, or public notice in a newspaper that is circulated locally describing the proposed project during the project planning phase for projects outside of the WUI. The notification will be used to inform stakeholders and to solicit information on the potential for significant impacts during the project planning phase.

4.1.3.4 **Rangeland Base and Ownership**

The majority of California's working landscapes are rangelands. These lands are primarily managed for commodity production and/or services. "Rangelands" or "primary rangelands" include the area of all rangelands, regardless of availability, with suitable vegetation for grazing livestock, excluding conifer forests and upland hardwood forests associated with conifer forests. Included in these lands, however, are some conifer woodland types – typically semi-arid highland areas with very open canopies dominated by pinyon pine and/or juniper and sagebrush. In California, there are substantial areas of forest land particularly within the U.S. Forest Service (USFS) grazing allotments. Though these allotments are often used for grazing, they are not shown in the estimate because forage output is transient, often only related to areas with little tree cover following harvesting or fire. These lands are termed "secondary rangeland" and limited information on grazing activities and other measures related to condition are provided.

A majority of rangelands are in public ownership, with the Bureau of Land Management being the largest public land managing agency. Forty-three percent of rangeland habitats within California are privately owned, while fifty-seven percent are publicly owned. This ownership pattern varies among the bioregions of the State.

MANAGEMENT BY PRIVATE LANDOWNERS

The largest group of private landowners managing rangeland is the range-livestock community. This class of owners may include land owners who have conservation easements or similar arrangements. Data comes from the USDA National Agricultural Statistics Service as part of their five-year national census.

Characteristics of rangeland owners seem to be approximated best by the category of "beef cattle (except feedlots)." In 1997, there were over 11,500 beef cattle farms (excluding feedlots) in California. Nearly 72 percent of these farms statewide are less than 500 acres in size.

Sole proprietorship is by far the most common form of ownership in all farms, including those with cattle sheep and goats. Partnerships are the second most common ownership, with family-held corporations next. In 1997, about three quarters of all farms were in sole proprietorship (National Agricultural Statistic Service, 2001a). About 85 percent of farms reported as beef cattle (except feedlots) are sole proprietorships.

FORAGE USE

The range livestock industry utilizes cropland, woodland, and pasture/range for forage. Both private and public lands may be grazed. Ranches may use some or all of these resources. Farms greater than 2,000 acres had a greater dependence on pasture/range other than cropland or woodland for grazing than smaller farms (National Agricultural Statistics Service, 2001a).

About 60 percent (34.1 million acres) of all available rangeland is grazed by livestock in California. Ninety percent of total range forage grazed each year by livestock comes from private lands (where the VTP will function), with the remainder coming from federally managed lands such as the BLM. Although private lands are much more productive (due to grasslands, better growing conditions, low elevation, year-round grazing), they comprise less than half (41 percent) of the total rangeland grazed by livestock as shown in Table 4.1-10.

Table 4.1-10 California rangeland area by management (thousands of acres) (FRAP, 2010).

Rangeland Vegetation Type	Private	USFS	BLM	NPS	Other Public	NGO	Total*
Shrublands (chaparral, sagebrush)	4,842	5,806	2,353	282	1,180	60	14,522
Grasslands	9,525	376	433	82	831	159	11,407
Desert types	3,540	137	10,450	4,772	4,325	27	23,251
Conifer Woodland	466	989	469	317	137	21	2,399
Hardwood Woodland	4,296	284	193	19	456	45	5,292
Hardwood Forest	2,828	1,305	194	104	151	12	4,594
Total	**25,497**	**8,897**	**14,092**	**5,576**	**7,080**	**324**	**61,465**

*Totals may not add up due to rounding

Grassland vegetation provides the most important source of forage for grazing livestock. Other important vegetation types for grazing are Hardwood Woodland and Hardwood Forests, which often occur adjacent to grasslands and have an understory of grasses. Livestock grazing occurs on land subject to private and public permits. In the last decade, the amount of authorized grazing has declined on federal land (FRAP, 2010).

4.1.3.4.1 Environmental Factors on Rangeland

RIPARIAN AREAS

While only a portion of total precipitation falls on California rangelands, almost all surface water in California passes through rangeland at some point in its cycle. In addition, two-thirds of the major reservoirs are located on rangeland. Therefore, rangeland hydrology greatly influences the quality of California's surface waters (Harper et al., 1998a). The grazing activities conducted on rangelands and their effects on soil and water quality are of particular concern for maintaining hydrological function.

The impact grazing has on surface hydrologic condition depends primarily on the behavior of the livestock, including feeding, drinking, waste production, and traveling. The timing and the intensity of grazing also have an impact. The resultant effects of these behaviors can lead to excessive vegetation removal (over-grazing), potential erosion due to soil baring, accelerated channel bank erosion due to trampling, stream temperature increase due to removal of riparian vegetation, water pollution from direct nutrient and pathogen deposits, and habitat degradation in wet meadow areas (Dahlgren et al., 2001). Key issues related to water quality are cost effective management of riparian zone grazing practices.

PLANT COMMUNITY COMPOSITION

Plant community composition is the species type, structure (size and density), and diversity of vegetation on rangeland. The ability of a rangeland site to support these characteristics, resist loss of function and structure, and recover help define rangeland condition from a vegetative perspective. Major changes have occurred to rangeland plant composition since the late 1800s and society’s heavy demand on resources (Menke et al., 1996). Historic changes in rangeland vegetation, primarily for the Sierra bioregion, were marked by substantial over-grazing, introduction of large fires for forage improvement and unrestricted livestock foraging in riparian areas. Substantial changes have taken place to recover the Sierra rangelands during the last two decades, including a slow recovery of upland wet meadows and re-vegetation of riparian areas following improvements in grazing practices.

HARDWOOD RANGE CONDITION CHANGES

California’s hardwood rangelands are the nearly 10 million acres of hardwood forests and woodlands that are composed primarily of oak tree species but may also contain other hardwood tree species as well. The annual and perennial grasses found within California’s hardwood rangelands are an important source of rangeland forage for California’s livestock industry (IHRMP, 2000a). These lands are generally located adjacent to the Sacramento Valley, San Joaquin Valley, and smaller coastal valleys within the Coast Range. While mapping efforts directed at California’s hardwood rangelands are useful for translating vegetation condition into wildlife habitat values, they are less useful as assessment tools when measuring condition variables such as rangeland forage, soil, and water quality. As such, soil and water quality conditions and trends are poorly quantified across hardwood rangelands.

Livestock grazing has both positive and negative influences on hardwood rangeland condition. Positive influences include reduction in moisture competition between oak seedlings and annual grass species as well as reduction in fine fuels that influence fire spread rates. Negative influences on hardwood rangelands include potential for increased soil compaction, alteration of stream hydrologic function, and direct impact on oak seedling regeneration. Some recent findings by IHRMP on sustainable practice research include canopy management of oak for improved forage yields and appropriate methods measuring the utilization of rangelands.

Historically, ranchers removed oaks as a means to increase forage production by reducing competition for limited amounts of moisture and sunlight. Most studies on this topic have demonstrated that increased forage production is possible in rangelands dominated by blue oak (*Quercus douglasii*) if precipitation exceeded 20 inches per year and tree canopy cover exceeded 25 percent of total area. In areas with less than 20 inches of rainfall and less than 25 percent canopy cover, forage yields were greater than adjacent open grassland areas. Moderate blue oak canopy cover (25 to 60 percent) had a variable effect on forage production.

Current research on this topic concludes that the benefits of oak removal generally decline within 15 years due to the loss of an organic matter source sustaining soil quality and the disruption of the nutrient cycling processes. Conversely, there has been little impact on soil quality under light to moderate grazing pressures given organic matter inputs from grazing livestock. In addition, during periods of drought, the shading provided by an oak canopy results in longer retention of soil moisture, thus maintaining green forage for a longer period into the dry season.

CONDITION OF NON-FEDERAL ANNUAL GRASSLANDS

Annual grasslands provide approximately 84 percent of the forage used for domestic livestock grazing on California’s forests and rangelands (FRAP, 2003). This percentage includes annual grassland as well as the annual grass understory component of valley and foothill woodland, coastal scrub, and chaparral land cover types. Early assessments mandated by Congress (e.g., Renewable Resources Planning Act, and Soil and Water Resource Conservation Act) reported California’s annual rangelands to be in “poor” condition. This conclusion was based on an evaluation of California’s grasslands according to perennial grassland standards. In these standards, assessment criteria and methods place annual-dominated plant communities into lower condition classes. The plant succession concepts and application methods developed for perennial grassland (such as Midwestern prairies) are not sufficiently similar to the annual grassland ecosystem function to allow comparison (George et al., 1990).

DEVELOPMENT ON RANGELANDS

Rangelands have faced disproportionate development and conversion pressure relative to other vegetation and land cover types in the state (FRAP, 2010). Outside of the less-productive desert and other arid regions, rangeland is often found on easily developed rolling terrain near sea level or at low elevations, and frequently surrounds what have become urban and suburban areas. Moreover, the majority of areas that now comprise the great metropolitan areas in the state, such as in and around Los Angeles, San Diego, the Inland Empire and San Francisco's south and east bay, were nearly all originally covered in rangeland vegetation types.

The trend of rangeland at risk from development has continued. A recent study of ecosystems determined that rangeland types appears as the top two (and five out of the top six) WHR types at risk from development (FRAP, 2010). The study overlaid spatially-explicit population projection data from the EPA with WHR and tree seed zone delineations to rank areas as low medium or high. The areas most at-risk were determined to be at the periphery of the main metropolitan areas, where the large urban and suburban growth is most likely going to occur.

ECONOMIC IMPORTANCE

Despite rangelands covering approximately 54 percent of California, agriculture and its livestock sub-sector have declined in relative importance within the state's economy. The declining relative importance of goods production and a rise in services, trade, finance and other non-goods producing activities are characteristic of the structural change that swept the nation and the region in latter half of the twentieth century. Even with this structural transformation California has been the nation's largest dairy producer since 1993, and accounted for 21 percent of the nation's milk supply in 2009.

In 2009, total cash receipts for sheep and lambs were about $37 million, representing an increase from 2007 levels, but an overall downward trend of close to 40 percent from the 2000 levels. In 1990, 39 California counties had cattle and calf production values (beef and dairy) within their top five agricultural commodities. In 2009, 31 counties listed cattle and calf production by value as among their top five agricultural products. California's cattle and calf commodity was the fifth leading agricultural production commodity by gross value for the state in 2009, surpassed by milk and cream, grapes, nursery products, and almonds. The five leading counties for cattle and calf production and their percent of state total were Tulare (17.9%), Fresno (13%), Imperial (12.4%), Merced (9.3%), and Kern (7.5%). The five leading counties for sheep and lamb production and their percent of state total included Fresno (19.6%), Solano (12.2%), Kern (12%), Imperial (10.4%), and Merced (5.2%). While each of these counties contains open rangeland, a large portion of their contribution comes from production in feedlots.

Sales of beef cattle comprise over 90 percent of the income generated from livestock operations. However, prices for sheep, cattle, meat, wool, and other products tend to reflect global markets, trade factors, and other conditions. There is a high degree of integration in the North American cattle market. U.S. cattle inventories exceed Canadian inventories by almost ten-fold; inventory highs and lows tend to parallel each other. U.S. and Canadian fed steer prices generally run closely together. In general, prices follow a cycle that is related to biological and market factors. Long-term cattle prices are determined in the U.S. market, but increasingly American producers compete with foreign imports of beef. For example, several large hamburger and restaurant chains in the United States import significant portions of their meat. At the same time, growth of foreign producers such as Australia and New Zealand has increased competition for American producers who wish to export. This adds downward pressure on prices received for American cattle. This trend is likely to continue for the near future as prices in California largely reflect these kinds of factors. They, too, are cyclical and have varied greatly in the last decade.

4.1.4 PROGRAM TREATMENTS - WUI, ECOLOGICAL RESTORATION & FUEL BREAKS

This section provides more detail of the discussion in Chapter 2.2 which further explains the analysis used for each Program Treatment described:

WILDLAND-URBAN INTERFACE (WUI)

The WUI is the geographical overlap of two diverse systems, wildland and structures. At this interface, the buildings and vegetation are sufficiently close that a wildland fire could spread to a structure or a structure fire could ignite wildland vegetation.

ECOLOGICAL RESTORATION

Ecological Restoration is the application of re-establishing the composition, structure, pattern, and ecological processes necessary to facilitate terrestrial and aquatic ecosystem sustainability, resilience, and health under current and future conditions.

FUEL BREAKS

Fuel breaks are an area in which flammable vegetation has been modified to create a defensible space in an attempt to reduce fire spread to structures and/or natural resources, and to provide a safer location to fight fire. These treatments can be a part of a series of fuel modifications strategically located along a landscape.

4.1.4.1 Fuel Rank Potential Fire Behavior

Quantifying the potential fire behavior across the landscape is the first step in developing a comprehensive fuel management strategy. FRAP developed a Fuel Rank assessment product for the 2010 Strategic Fire Plan for California to identify and prioritize the location of fuel reduction projects to ultimately reduce the potential for large wildland fires. The fuel ranking methodology assigns ranks based on the expected fire behavior for unique combinations of topography and vegetative fuels under specific weather conditions (wind speed, humidity, and temperature). The procedure makes an initial assessment of rank based on an assigned fuel model and slope. From fire behavior modeling results, surface ranks can be assigned according to the rate of spread and heat per unit area associated with each unique fuel model-slope combination. The amount of ladder and/or crown fuel present is used to adjust the rank to arrive at a final fuel rank.

Table 4.1-11 Fuel Rank acreage estimates in the SRA by bioregion

Bioregion	Moderate	High	Very High	Total by Fuel Rank	Total Fuel Rank High & Very High
Bay Area/Delta	1,060,569	1,341,436	433,020	**2,835,026**	**1,774,457**
Central Coast	1,396,246	2,841,383	341,162	**4,578,791**	**3,182,545**
Colorado Desert	216,612	196,999	91,103	**504,713**	**288,101**
Klamath/North Coast	1,799,172	3,867,956	1,474,289	**7,141,417**	**5,342,245**
Modoc	517,481	1,873,317	418,231	**2,809,029**	**2,291,548**
Mojave	404,446	218,553	92,505	**715,504**	**311,058**
Sacramento Valley	612,165	525,735	50,998	**1,188,899**	**576,734**
San Joaquin Valley	917,309	477,345	36,141	**1,430,795**	**513,486**
Sierra Nevada	1,811,784	3,022,127	1,231,076	**6,064,987**	**4,253,203**
South Coast	393,916	925,118	589,082	**1,908,116**	**1,514,200**
Total by Treatment	**9,129,701**	**15,289,968**	**4,757,607**	**29,177,276**	**20,047,575**

Of the three determinants that drive fire behavior – topography, weather, and fuels – only fuels can be modified in order to change fire behavior. When fuels are modified, two important fire behavior charactersitics are altered: fire line intensity and rate of spread. By moderating the fuels, suppression activities become safer for fire fighters and fire control effectiveness would increase and ultimately become more successful in keeping fires small and more controllable. In turn, this should result in fewer costly large fires. Concurrently, reducing intensity will reduce severity, thus minimizing losses to values at risk. Table 4.1-11 provides a summary of Fuel Rank acreages within the SRA for each bioregion. It should be noted that of the total SRA acreage, approximately 69 percent is classifed as High or Very High hazard areas. Within the WUI, projects would be designed to reduce areas of High and Very High Fuel Ranks while maintaining those areas that remain in the Moderate class. Figure 4.1-1 illustrates this relationship across California.

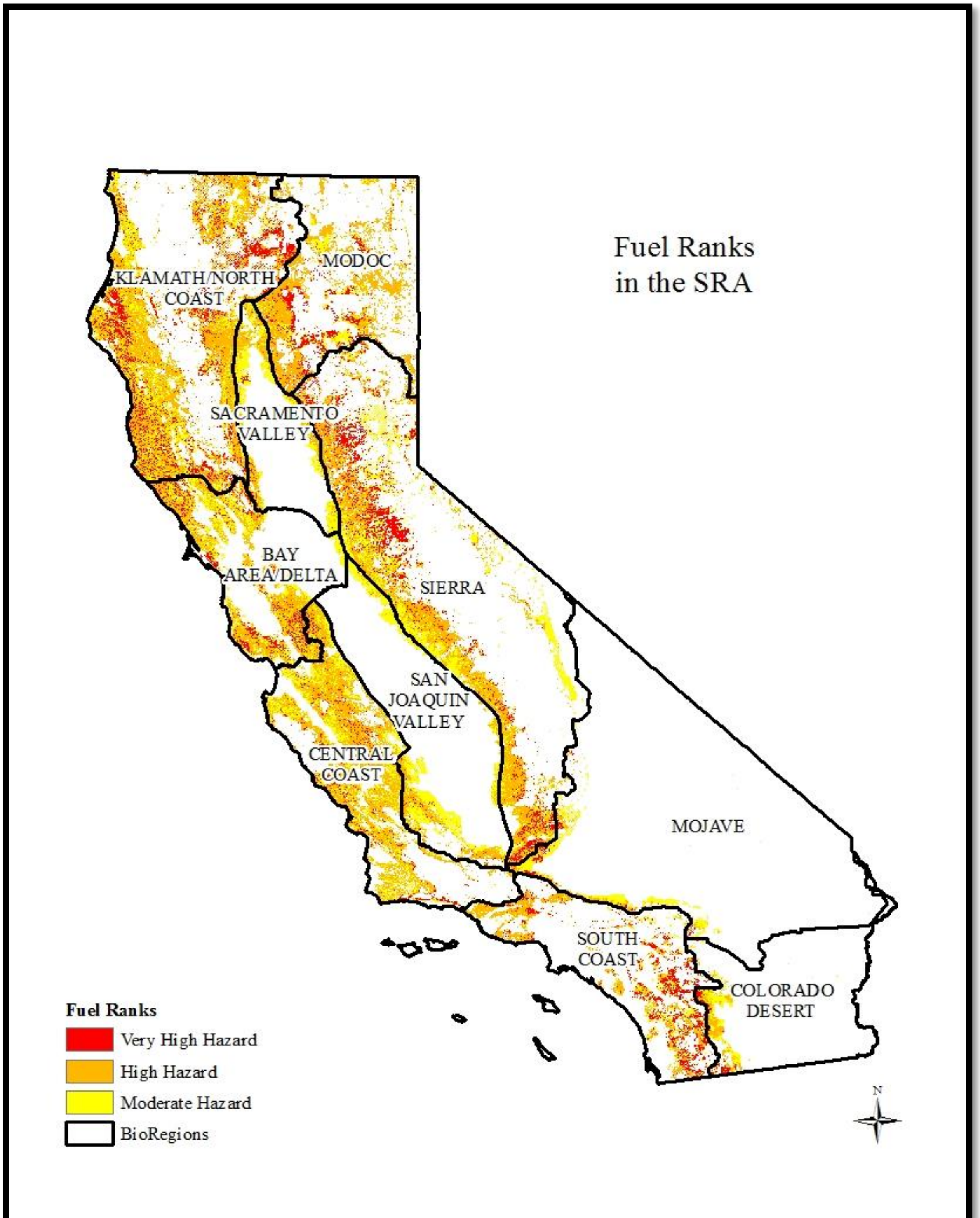


Figure 4.1-1 Fuel Rank Potential Fire Behavior in the SRA

Flame length and/or flame height is the firefighter's gauge to assess fire line intensity, and this indicator aids in deciding how to attack a wildfire safely. Figure 4.1-2 shows a physically-based relationship between flame height, radiant energy, and the distance necessary for safe firefighting and/or safety zones (Butler and Cohen, 1998). At the project scale, tools such as the model illustrated in Figure 4.1-2 can be used to help design fuel treatments that firefighters can access and anchor from safely. It can also be used to define appropriate treatment zones for the protection other values at risk (e.g., evacuation routes for civilians).

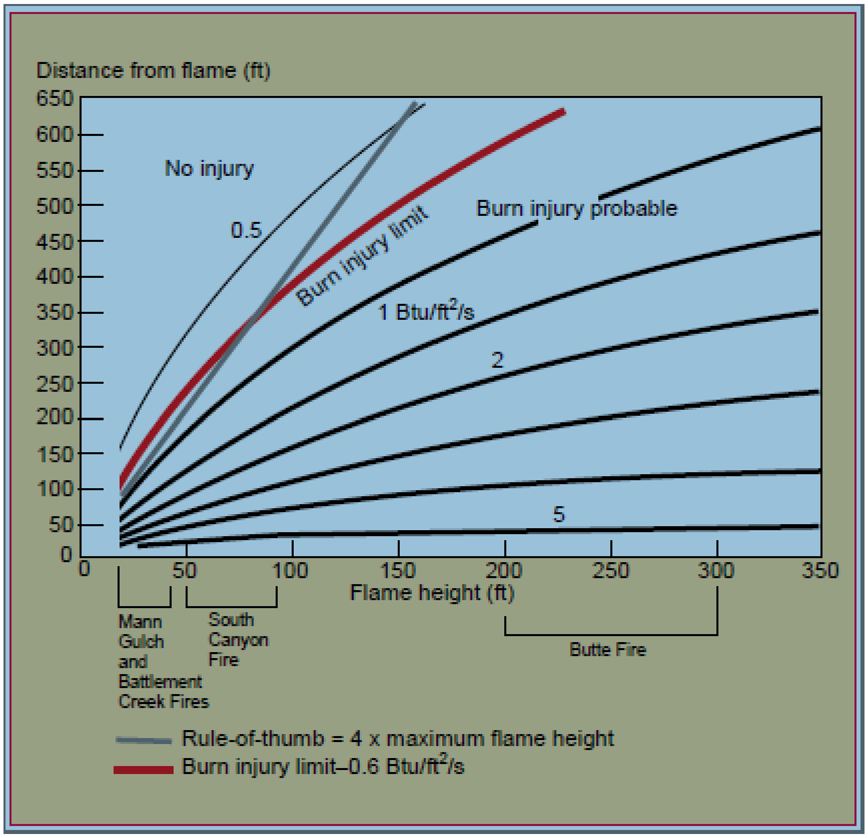


Figure 4.1-2 Lines represent predicted radiant energy arriving at the firefighter as a function of flame height and distance from the flame. It is assumed that the firefighter is wearing fire-retardant clothing and protective head and neck equipment. The heavy shaded line represents the burn injury threshold of 0.6 Btu ft^{-2} s^{-1}. The heavy solid gray line indicates the rule of thumb for the size of the safety zone (Figure from Butler and Cohen, 1998).

Rate of spread is an indicator of the number of resources needed to build fire containment lines quickly enough to arrest or stop an advancing wildfire. One of the VTP goals is to change the fuel characteristics in many areas where there is a high level of public exposure so that wildfire, when it occurs, may exhibit a less intense flaming front or slower rate of spread. By reducing the fuel rank, firefighters will have an improved probability of success at suppressing wildfires, thus resulting in fewer acres burned. Table 4.1-12 illustrates the probability of success within each vegetation type.

Table 4.1-12 Quantification of suppression effectiveness in different vegetation types

Life Form	**Grass Dominated**	**Shrub Dominated**		**Tree Dominated**	
		Young	**Old**	**Litter**	**Crown**
Subtype	Annual Perennial	General Shrubland Desert Shrubland		Hardwood forests Long-needled conifers Short-needled conifers	
Expected Fire Behavior	Surface Fire: expected rate of spread is moderate to high, with low to high fire intensity (flame length)*	Surface/crown fire: expected rates of spread and fire line intensities (flame length) are moderate to high*	Crown fire: control efforts at the head of the fire are ineffective**	Surface (litter): spread rates are low to moderate, fire line intensity (flame length) may be low to high**	Crown fire: control efforts at the head of the fire are Ineffective**
Fuel Rank	**Probability of Initial Attack/Extended Attack Success**				
Very High	Less Likely	Not Likely	Not Likely	Highly Likely	Not Likely
High	Likely	Likely	Not Likely	Highly Likely	Not Likely
Moderate	Highly Likely	Very Likely	Likely	Highly Likely	Not Likely

*Probability of success is driven by flame length and rate of spread (NWCG, 2014)

** NWCG Fireline Handbook Appendix B (2006)

4.1.4.2 Wildland-Urban Interface

The Wildland Urban Interface (WUI) is an area where human development is located in close proximity to fire-prone open space, native vegetation, and/or habitat. The WUI creates an environment in which fire can move readily between structural and vegetation fuels. Once homes are built within (or adjacent to) natural habitat settings, it increases the complexity of fighting wildland fires because the goal of extinguishing the wildland fire is often superseded by protecting human life and private property. Nowhere is this more apparent than in California. Most of the population lives in lower elevations dominated by chaparral shrublands susceptible to frequent high-intensity crown fires. Hence, the WUI's location, extent, and dynamics will continue to be a driver for wildland fire management.

Beginning in 2001, CAL FIRE FRAP began developing maps of the WUI as part of a requirement for states under the National Fire Plan (USDA and USDI, 2000). The mapping efforts resulted in map data and the original compilation of Communities at Risk for California and were published in the National Registrar. Since that time, the principle concepts utilized by CAL FIRE FRAP have become standardized in numerous national-level mapping efforts.

With respect to defining the WUI, there are three main components used in combination to arrive at a spatially definable area (used to provide the geographical landscape for modeling purposes):

Using these three building blocks, maps were developed that define not only the total footprint of what can be considered "WUI", but also contains specific information within that footprint that supports the development of strategies to prioritize mitigation efforts to achieve efficient results. All three components contribute to a risk assessment of potential loss from wildland fire. In other words, the larger the hazard, the more assets exposed, and the closer these components are to one another effectively increases the risk of loss.

WILDLAND FIRE HAZARD

Fire threat is derived from the integrated assessment of wildland vegetation fuels, terrain, expected fire weather, and past fire occurrence. Threat is a measure of the combined influence of both the potential for burning and the expected fire behavior. For the specific purposes of characterizing the fire threat to houses and other human assets, "Fire Threat Exposure" was developed by FRAP to reflect a specific area's capacity to ignite from both a spreading fire front and from firebrands produced from the fire front. Threat exposure thus integrates fire threat across the landscape to represent the combined influence of all lands producing heat from both flames and firebrands that could result in exposure to a house.

HUMAN ASSET EXPOSURE

Census data and land cover information on commercial properties were utilized by FRAP to develop a data layer that characterizes these assets, or communities, along a structure density gradient. In other words, greater structure density carries more value per unit area, and hence when exposed to hazards represents a greater risk of loss. The following descriptions range from high to low density areas. Areas with greater than one house per acre and commercial lands were defined as "Urban." Areas with housing ranging from one house per acre to one house per five acres were designated as “Rural Residential.” Lands supporting homes on the scale of one house per five acres to one house per twenty acres were defined as “Intermix” (Table 4.1-13). Lands that contained a lower density than one house per twenty acres were not considered as having sufficient asset concentration to be considered WUI.

Table 4.1-13 WUI classification housing density definitions

WUI Classification	Density
Urban	greater than 1 house/acre and commercial lands
Rural Residential	between 1 house/acre and 1 house/5 acres
Intermix	between 1 house/5 acres and 1 house/20 acres

PROXIMITY

The final concept used by FRAP to define the WUI is proximity. In basic terms, proximity refers to the intersection between human assets and the wildland fire threat. Reflecting that many fires which impact areas of assets come from adjacent wildland areas, a zone of influence around community areas was developed that represents the proximal lands where fuel reduction treatments would likely influence risk to people, property, and other infrastructure.

Taken in total, a combination of the three concepts (fire hazard, human assets, and proximity) creates a complete picture of the WUI which reflects specific hazard levels, asset concentrations and value, and the spatial relationship between the two. Higher hazard levels, more assets exposed to those hazards, and nearness all are important considerations in spatially defining the WUI.

For assessing threat of wildland fire to people, buffers were developed using a cost distance function in which urban areas and areas of “little” or “no threat” have higher costs while all other areas have lower cost. Thus, the maximum distance of the buffer in areas where all costs are low is approximately 1.5 miles. The 1.5 mile buffer distance was adopted in accordance with the 2001 California Fire Alliance definition of “vicinity,” which is an approximate distance that embers and flaming material (firebrands) can be carried from a wildland fire to the roof or other part of a structure.[1] For areas where the

[1] While this buffer distance may appear overly large to some, it is important to note that the 1.5 mile buffer is intermediate in value to those discussed historically when characterizing communities at risk. Dave

entire buffer cost takes on higher values, the maximal buffer distance is approximately 0.5 miles. Areas with mixed costs have buffer distances within this range. This concept reflects the greater resistance that urban areas and areas of little or no threat (such as agriculture lands) offer to the spread of wildland fire. Thus, areas of greater threat class take precedence over areas with lesser or no threat class.

4.1.4.2.1 WILDLAND-URBAN INTERFACE ZONE OF INFLUENCE

Defining and mapping the WUI is necessary for prioritizing areas in need of risk assessment and mitigation measures. Many strategies designed to protect these areas from wildfire typically focus on fuel reduction projects outside the immediate area of development. This required additional analysis to determine the scope of the area and key characteristics that might be used to define where mitigation work could be best suited. As these areas will typically be located adjacent to WUI communities, they can be approximated by defining a “Zone of Influence” area around developed areas and describing key characteristics based on innate wildfire conditions such as expected fire frequency and potential fire behavior (i.e. Wildland Fire Threat). This spatial land allocation allows for the inclusion of landscape level fuel reduction treatments to be placed in a pattern that reduces risk to WUI assets (Figure 4.1-3). This process also allows for the achievement of broader ecological objectives of modifying fire effects in fire-adapted forests, woodlands, grasslands, and shrublands at the landscape scale (Weatherspoon and Skinner, 1996; Finney, 2001).

The zone of influence model combines population density, proximity to the wildland, and the wildland fire threat to arrive at true representation of how the WUI is reflected spatially (Figure 4.1-3). The model assigns the labeling of these areas based on a priority of proximity and then density (higher density prioritized over lower density). By including measures of both proximity and asset density exposed to wildfire risk, the classification is designed to allow for prioritization of treatments based on characteristics that would likely result in higher levels of risk reduction to those features contained within the WUI. Under the VTP, all of the WUI would be potentially available for treatment. However, actual treatment would then depend on landowner interest to utilize the Program as well as other local site specific constraints. Table 4.1-14 presents acreages, according to bioregion, that are classified as WUI within SRA.

Sapsis (personal communication), FRAP lead analyst of California’s Community at Risk mapping effort, recounts that United States Forest Service representatives from the Cleveland National Forest suggested a 6-mile wide WUI buffer based on potential fire growth in a single burning period during initial stages of mapping communities at risk. The 6-mile distance to structures is also significant variable in predicting higher suppression cost (Gude et al., 2013).

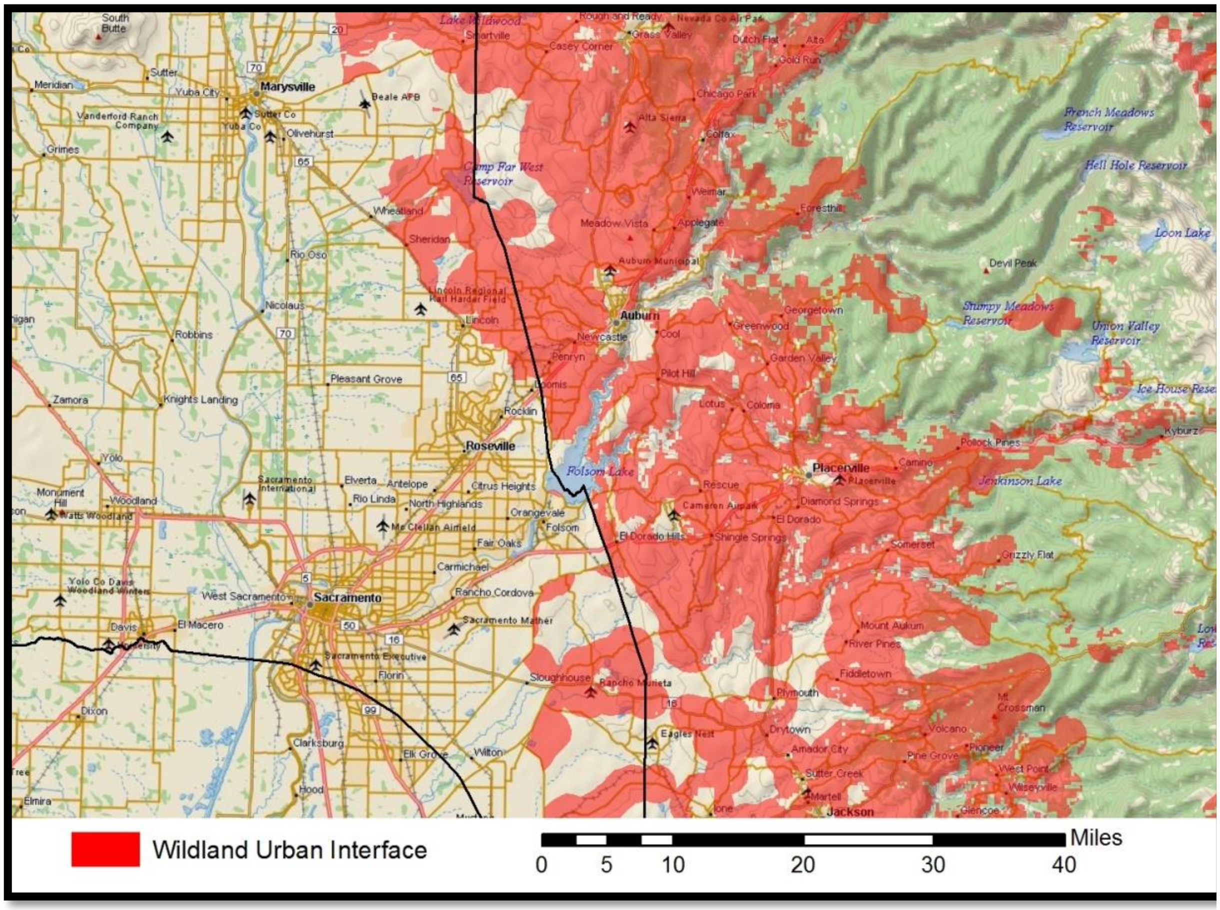


Figure 4.1-3 Example of Wildland-Urban Interface within the SRA for the Sierra foothills region

Table 4.1-14 WUI acreage estimates in the SRA by bioregion (treatable acres)

Bioregion	WUI
Bay Area/Delta	1,478,478
Central Coast	1,597,985
Colorado Desert	119,585
Klamath/North Coast	2,273,106
Modoc	784,269
Mojave	267,527
Sacramento Valley	521,311
San Joaquin Valley	345,424
Sierra Nevada	2,986,664
South Coast	1,349,996
Total by Treatment	**11,724,346**

As illustrated throughout the VTP, fuel treatments are intended to help limit wildland fire size and severity by either directly or indirectly mitigating fire behavior. Activities such as prescribed burning, mechanical thinning or hand pruning can lower the rate at which fire spreads and decrease fire behavior in order to support fire suppression efforts (Finney, M Finney, 2001). In addition to the traditional sense of WUI fuel treatments protecting a community, the relationship can also work in the other direction. Providing fuel treatment along a community can also help protect the vegetation and associated wildlife habitat in the wildland. Figure 4.1-4 helps illustrate this relationship. This association may also be a value in fuel break design along roads and critical infrastructure. Figure 4.1-6 provides a WUI treatment example.

Figure 4.1-4 Benefits of the WUI fuel treatments may work both ways as supporting fire prevention of structure fires and wildland fires.

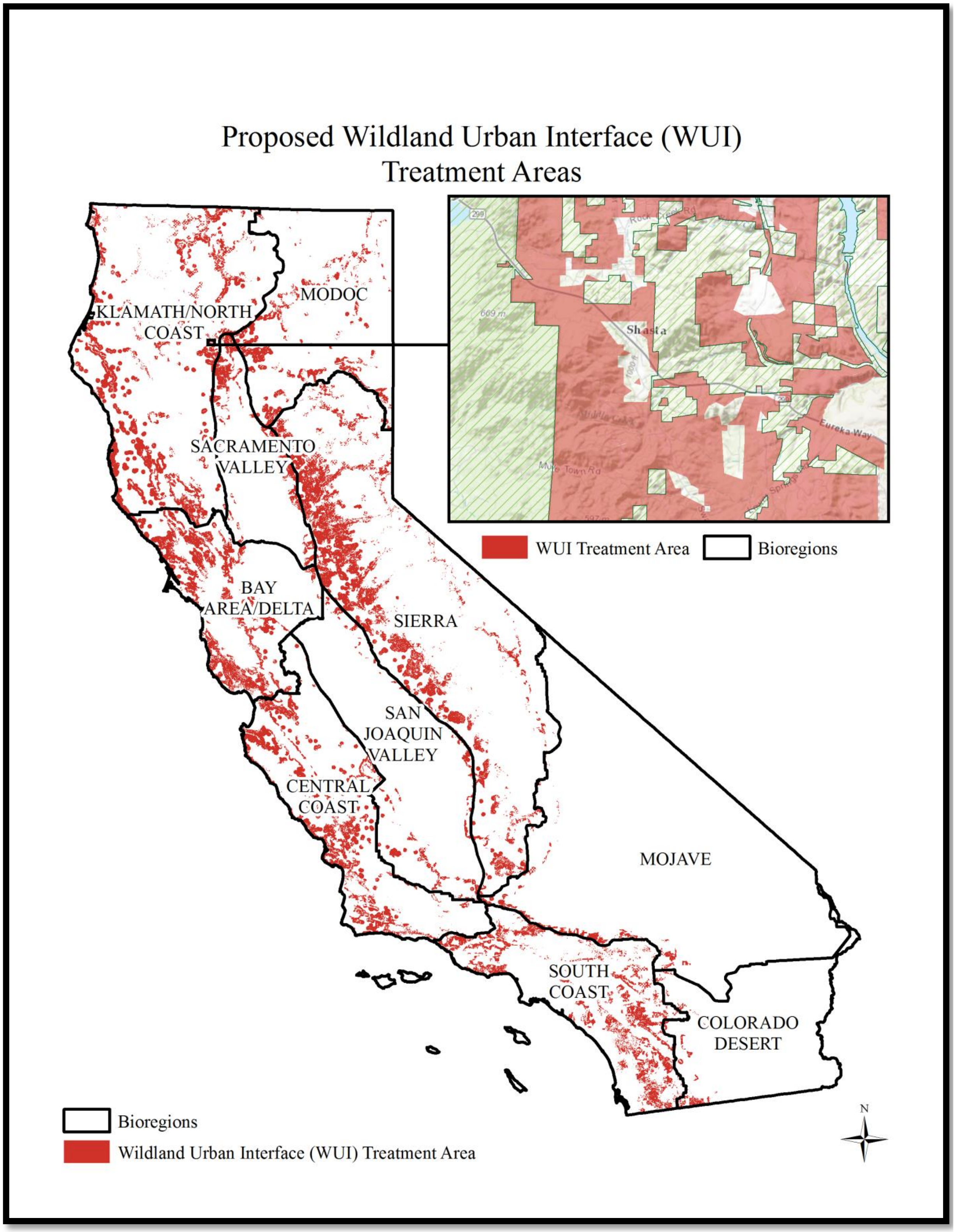


Figure 4.1-5 Wildland Urban Interface within the SRA

Figure 4.1-6 Example of a WUI treatment to protect structures by fuel reduction

4.1.4.3 Ecological Restoration

Fire is a natural process in many biomes and has played an important role in shaping the ecology and evolution of species (Pyne et al., 1996, Bond and Keeley, 2005). Periodic wildfire helps to maintain ecosystem processes and functions, particularly those in which taxa have developed strategic adaptations to fire (Pyne et al., 1996, Savage et al., 2000, Pausas et al., 2004). Despite the important ecosystem role played by fire, human activities have altered natural fire regimes relative to their historic range of variability (Shypard et al, 2007). In California, the two primary mechanisms altering fire regimes are fire suppression, resulting in fire exclusion, and increased human ignition sources resulting in abnormally high fire frequencies (Keeley and Fotheringham, 2003). Climate change, previous land use activities, and other indirect factors may also play a role in altering fire regimes (Lenihan et al., 2003).

While these patterns are widely applicable to many forested landscapes in the western United States, California chaparral shrublands have experienced such substantial human population growth and urban expansion that the increase in ignitions, coupled with the most severe fire weather in the country (Schroeder et al., 1964), have acted to offset the effects of suppression to the point that fire frequency exceeds the historic range of variability (Keeley et al., 1999). Because anthropogenic ignitions tend to be concentrated near human infrastructure, more fires now occur at the urban fringe than in the backcountry (Pyne, 1982; Keeley et al., 2004). Profound impacts on land cover condition and community dynamics are possible if a disturbance regime exceeds its natural range of variability, and altered fire regimes can lead to cascading ecological effects (Landres et al., 1999, Dale et al., 2000).

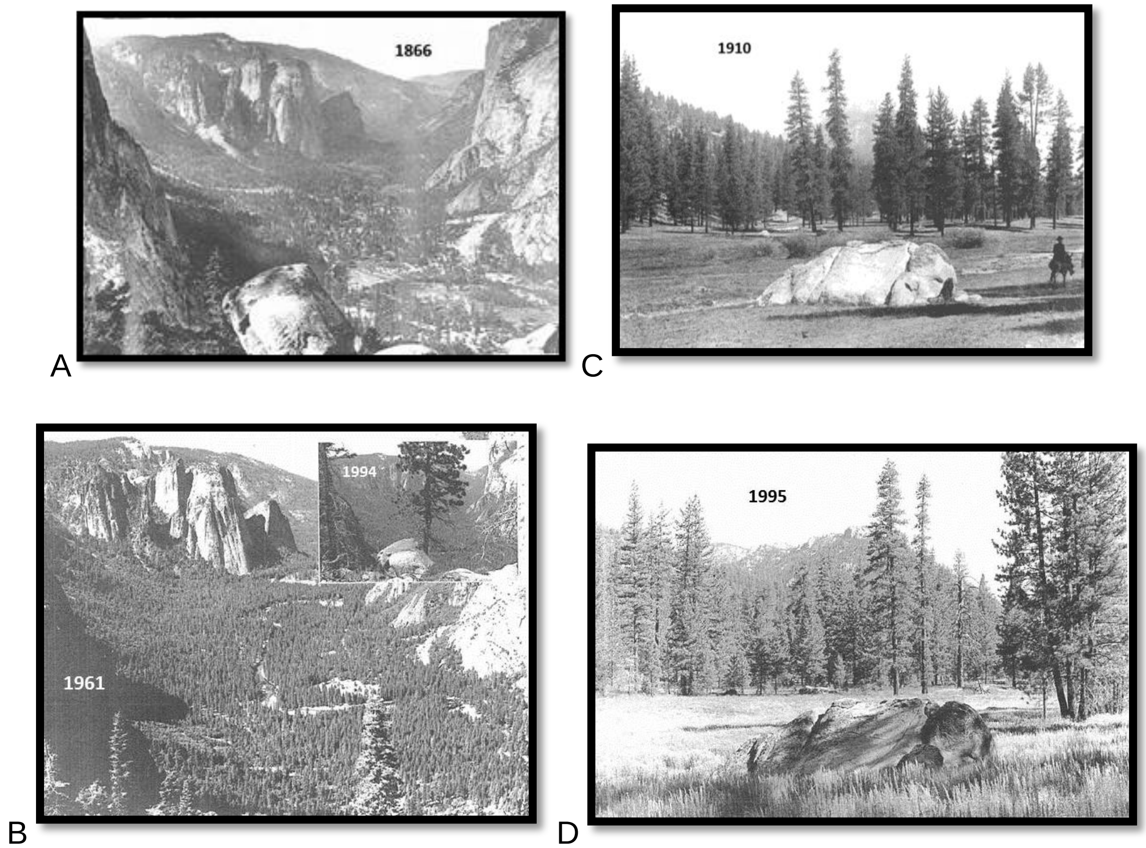


Figure 4.1-7 Photos demonstrating the concept of ecological restoration (taken from Gruell, 2001). The historic photos of Yosemite Valley (a) and Trout Meadows/Tulare County (c) indicate a condition analogous to Condition Class I, whereas the modern photos (B and D) reflect Condition Classes 2 or 3. Ecological restoration treatments would attempt to restore stand densities, fuel loading, and species composition to a condition that more closely resemble the historic photos (A and C).

4.1.4.3.1 CONDITION CLASS

A natural fire regime is a general classification of the role fire would play across a landscape in the absence of modern human mechanical intervention, but including the influence of aboriginal burning (Agee, 1993; Brown, 1995). Coarse scale definitions for natural (historical) fire regimes have been developed by Hardy et al. (2001) and Schmidt et al. (2002) and interpreted for fire and fuels management by Hann and

Bunnell (2001). Following the National Fire Plan concepts, FRAP integrates data specific to California for describing ecosystems and fire-related metrics used in other analyses to specifically define and describe fire-related risks to ecosystems. Fundamental to this idea is that current expected fires are compared to historic fire regimes with respect to fire frequency, size and patchiness, and effects on key ecosystem elements and processes. Thus, an area can be classified based on current vegetation type and structure, an understanding of its pre-settlement fire regime, and current conditions regarding expected fire frequency and potential fire behavior.

As a result of these efforts, "Condition Classes" were defined as the relative risk of losing key components that define an ecosystem (Hardy et al., 2001). The conceptual basis is that for fire-adapted ecosystems, much of their ecological structure and processes are driven by fire. Also, disruption of fire regimes leads to changes in plant composition and structure, uncharacteristic fire behavior, opportunities for pests, altered hydrologic processes, and increased smoke production (Table 4.1-15).

Table 4.1-15 Condition Class definitions used in assessment of risks to ecosystem health

Condition Class	Departure from Natural Regimes	Vegetation Composition, Structure, Fuels	Fire Behavior, Severity, Pattern	Disturbance Agents, Native Species, Hydrologic Functions	Increased Smoke Production
Low Cond Class 1	None, Minimal	Similar	Similar	Within Natural Range of Variation	Low
Moderate Cond Class 2	Moderate	Moderately Altered	Uncharacteristic	Outside Historic Range of Variation	Moderate
High Cond Class 3	High	Significantly Different	Highly Uncharacteristic	Substantially Outside Historic Range of Variation	High

Condition classes are assigned based on current vegetation type and structure as defined by California Wildlife Habitat Relationship type, size, and density as well as the unique combination of expected fire frequency and potential fire behavior.

Roughly 15.5 million acres within SRA are ecologically at risk from fire (Moderate and High Condition Classes) with almost 6 million acres at high risk (Table 4.1-16). These areas at risk span diverse ecosystems ranging from pine forests in the Klamath/North Coast to coastal sage scrub communities along the South Coast. Numerous areas within California are dominated by ecosystems at risk from wildfire. The only area without significant widespread ecosystems at risk is in the Colorado Desert Bioregion, where fire has and continues to largely be a rare phenomenon.

Table 4.1-16 Total Condition Class acreage of lands in SRA and percent of total land the acreage represents

Condition Class	Condition Class in SRA (Acres)	Condition Class Percent of Area
1 - Low	13,014,190	42%
2 - Moderate	9,723,970	31%
3 - High	5,816,383	19%
Non-Forest & Range	2,435,430	8%

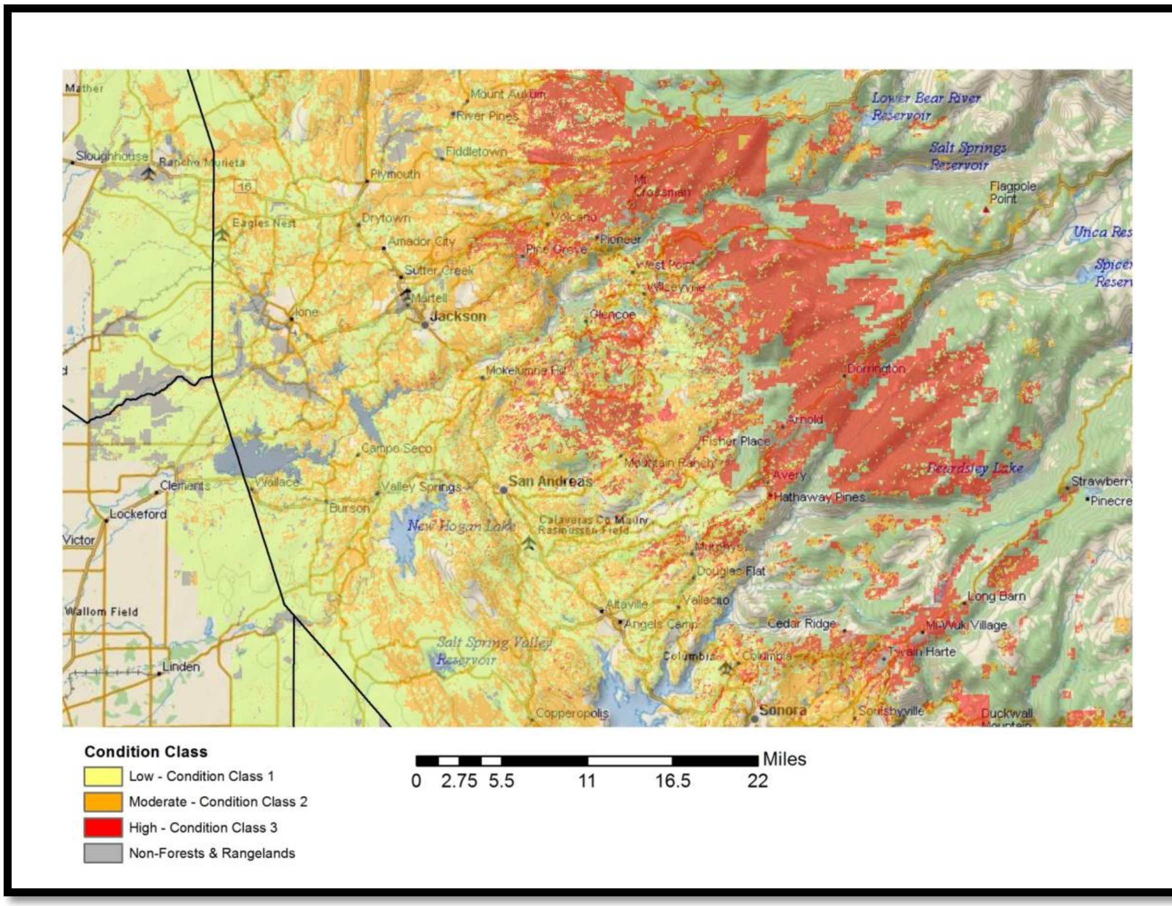


Figure 4.1-8 Example of Condition Class within the SRA for the Sierra foothills region.

A regional assessment of fire risk to ecosystems uses the total amount of area in the Moderate and High Condition Classes compared to the total area available. This regional summary also reveals the diverse types of habitats that fire threatens across California. Several of the forest bioregions have over 50 percent of the land base in Moderate or High Condition Classes (Table 4.1-16). These areas have vegetation structures and fire frequencies that have deviated from historical levels and pose High or Moderate risks to ecosystem health. Table 4.1-17 also shows the High risk typically associated with changed fire regimes of the South Coast and approximately 26 percent of the bioregion is classified as a High Condition Class. The Modoc region, dominated by sagebrush steppe and the pervasive influence of exotic annual grasses, has largely lost its basic ecological integrity and future fires only exacerbate the problem. Similarly, the forested area of the Klamath/North Coast and Sierra regions are at risk due to unnaturally severe fires, where post-fire succession may result in loss of forested cover for decades without active reforestation efforts. Figure 4.1-9 illustrates the condition classes throughout California.

Table 4.1-17 Condition class acreage estimates in the SRA by bioregion outside of the WUI

Bioregion	Non-Forests & Rangelands	Low	Moderate	High	Total Condition Class Moderate & High
Bay Area/Delta	68,750	1,821,610	1,231,906	1,726,879	**2,958,785**
Central Coast	173,129	293,125	623,384	1,032,370	**1,655,754**
Colorado Desert	65,147	437,047	184,721	205	**184,926**
Klamath/North Coast	225,878	1,221,955	1,122,540	537,878	**1,660,418**
Modoc	40,346	597,765	512,275	64,523	**576,798**
Mojave	57,276	945,972	139,076	5,672	**144,748**
Sacramento Valley	89,887	1,808,735	1,133,497	22,626	**1,156,123**
San Joaquin Valley	25,433	263,375	98,504	29,663	**128,167**
Sierra Nevada	18,889	92,186	145,171	81,256	**226,427**
South Coast	1,695	282,224	73,828	18,273	**92,101**
Total by Treatment	**766,430**	**7,763,994**	**5,264,902**	**3,519,345**	**8,784,247**

Under the Ecological Restoration project type, lands classified as Moderate and High Condition Classes outside of the WUI, where the site has departed from the historical fire regime, would be targeted for treatment. Treatments would focus on restoring vegetative communities and fire regimes to at least moderate condition to reduce the level of ecological risk. Ecological Restoration projects would typically occur outside of the WUI zone.

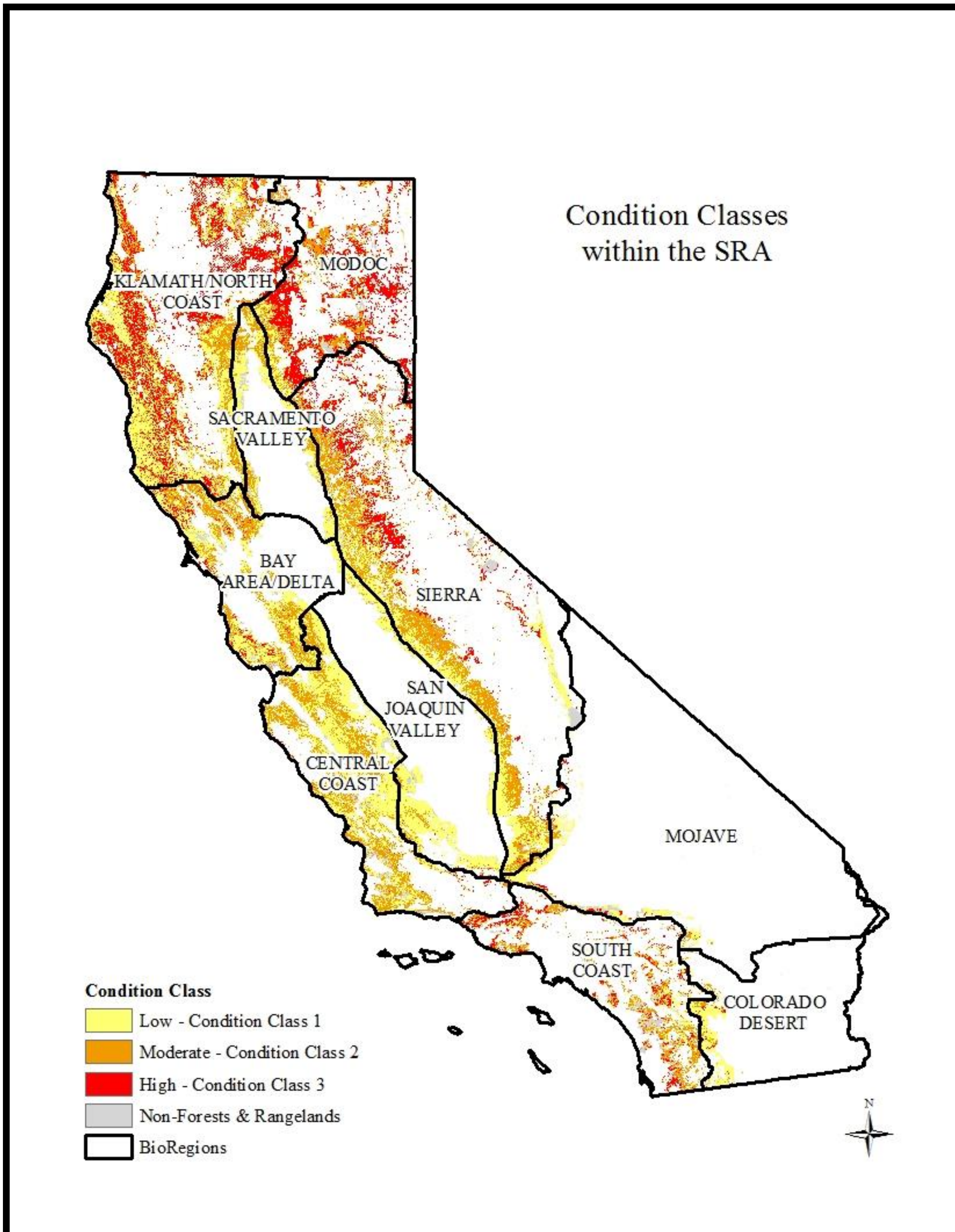


Figure 4.1-9 Fire-related risks to ecosystem health as measured by condition class within the SRA

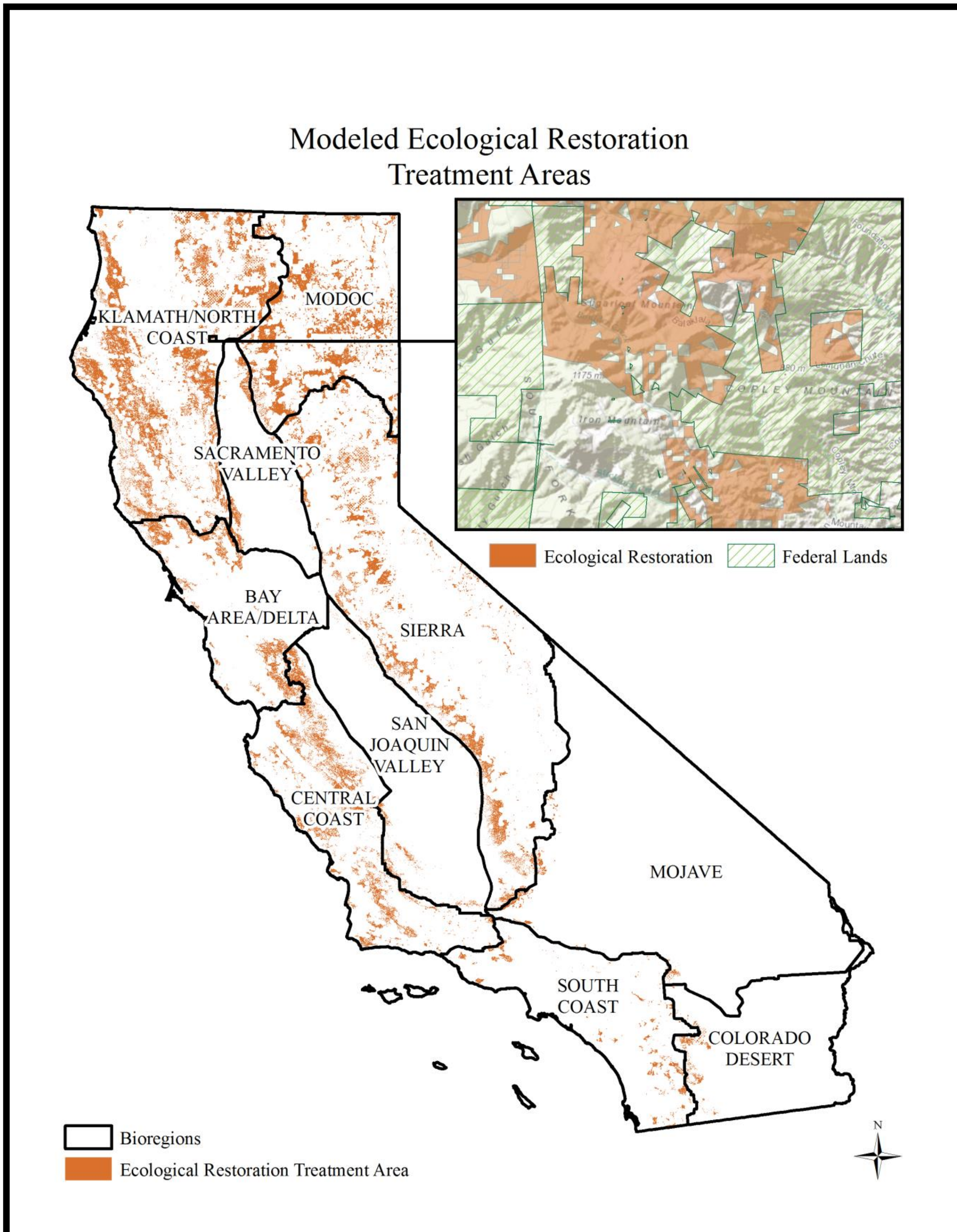


Figure 4.1-10 Proposed Ecological restoration Treatment areas within the scope of this Program EIR.

4.1.4.4 Fuel Break

Conceptually, fuel breaks are intended to provide strategic locations where fire suppression personnel can attack and contain the fire. The wide fuel breaks covered with low-volume fuels are expected to assure successful holding of fire lines in most situations where backfiring can possibly contain the fire. The location of fuel breaks are also located and designed to help protect certain assets at risk. Most commonly these include communities, critical infrastructure, and high value natural resources.

The light ground fuels located along fuel breaks are particularly useful when rapid burning out of a long line is needed to control a fire. Such actions are typically required to contain large brush fires at times when the moisture content of the fine fuels and relative humidity is higher, as is the case in evenings and mornings. Rapidly employed backfiring operations, and sufficiently manned fire lines generally increases the probability of fire containment. Fuel breaks remain a fundamental tool in controlling wildfires and continue to be useful in suppressing many fires before they grow beyond initial attack capabilities. More frequently however, the utility of well-placed fuel breaks is realized once the fire becomes large.

Fuel breaks are needed to fragment large areas of fuels, to safeguard access to forests or shrublands, and to ensure human safety and infrastructure investment. Clearing along fire control roads makes them more useable for travel during fires and allows them to serve as fire control lines under certain conditions. Clearing adjacent to highways and public roads provides both safe evacuation routes under hazardous fire conditions and safe access for firefighters. Fuel breaks located along ridge systems helps break up the landscape continuity of natural fuels into smaller blocks. Fuel breaks around or within residential areas, organization camps, groves of trees, or other areas of special value can be fitted into the overall fuel break system as well as the visual character of the sites they occupy.

An obvious limitation of fuel break system effectiveness is the heavy, flammable vegetation which normally remains on much of the adjacent untreated lands. Fires that occur on adjacent, untreated lands with heavy fuels are extremely difficult to control. Even with improvements in firefighting equipment and techniques which provide quicker, larger suppression responses during windy weather, smoky conditions, and during darkness, control of fires in heavy fuels will continue to be difficult and perhaps impossible under severe conditions. However, fuel breaks have been used many times to stop wildfires under severe fire weather conditions but generally not under the most extreme conditions (Keeley, 2002). During extreme fire weather, fuel breaks have been useful in reducing the lateral spread of fires, occasionally for stopping head fires during periods of reduced wind, and for making possible the protection of isolated communities.

Fuel breaks are not landscape features that will stop a fire by itself. They are dependent on fire suppression activity for successful application. Simply stated; fuel breaks allow the higher probability of successful fire suppression activity (Agee, et al., 2000). They are intended to be reinforced defensible locations for direct or indirect attacks on wildland fires (Finney, 2001).

Fuel breaks are commonly used in California for addressing fire risk. However, there is little empirical data of their role in controlling large fires. An article by Syphard et al. (2011) acknowledges this concern and conducted a spatial analysis of the Los Padres National Forest in southern California. They concluded that fires stopped at fuel breaks 46 percent of the time. Preexisting fuel breaks allowed fire suppression activity to take advantage of the lighter fuels along the ridge lines to cut control lines. This was useful in both the wilderness areas (utilizing hand line and hose lays) and areas outside the wilderness where heavy equipment could aid in suppression efforts (Syphard et al., 2011).

Colleen Mooney summarizes the advantage of fuel breaks in a 2010 study addressing Canada's boreal forest:

- *There is consensus in the literature that modification of forest fuels will alter wildland fire behavior (Agee et al. 2000, Alexander and Lanoville 2004, Fites and Henson 2004, Hirsch et al.2001, Martinson and Omi 2003, Martinson and Omi 2006, Omi et al. 2007, Graham et al. 2004 and others). The literature suggests that the primary purpose for fuel breaks is to change fire behavior as it enters the fuel-altered zone (Stratton 2004) resulting in limited, or slowed, fire spread (Davis 1951, Duguy 2007, Dennis 2005, Green and Schimke 1971, van Wagtendonk 1996); reduced flame lengths (van Wagtendonk 1996); and reduced probability of torching and independent crown fire (Agee et al. 2000). A fuel break can provide other numerous advantages as well: it can be used as an anchor point for indirect attack (Salazar and Caban 1987, Murphy et al. 1967); it can facilitate the rapid construction of a fire line/firebreak by suppression forces (Bevers et al. 2004, Murphy et al. 1967); it can provide safe access for ground suppression crews (Salazar and Caban 1987, Murphy et al. 1967); and can allow greater penetration to surface fuels of fire retardants dropped from the air (Agee et al. 2000, Murphy et al. 1967).*

Mooney also acknowledges the fact that fuel breaks need to be tailored to the topography, fuel characteristics, fire regimes and expected weather conditions to improve their effectiveness. A general rule for fuel break width would not be feasible given the diversity of California fuel types, topography and weather conditions. As a result, fuel break widths are variable through their locations across the landscape and through history (Agee, 2000). In addition, the volume of fuels that should be removed is also variable. Depending on the goal and intent of the fuel break, thinning may not be the only treatment activity. Reduction of surface, lateral, and canopy fuels should be considered. Figure 4.1-11 is an illustration of the relationship of fuel reduction and fire behavior within a fuel break. During the Zaca Fire in 2007 it was estimated that 33,000 hectares (approximately 81,500 acres) were burned from backfire activity where the significant effort was focused on fuel breaks along ridgelines (Syphard et al., 2011). The fuel break locations provide an advantageous area to apply backfires. It was also noted that the 1971 Romero Fire near Santa Barbara, was considered a successful use of fuel breaks to protect a large portion of the Santa Ynez River Watershed (Agee et al., 2000). In general, fuel breaks should be constructed as wide as possible (while considering other values at risk) to increase effectiveness in controlling large wildfires while providing for firefighter safety. It is important to note that fuel treatments outside a fuel break can also help with the success of fuel break design (Van Wagtendonk, Jan W, 1996).

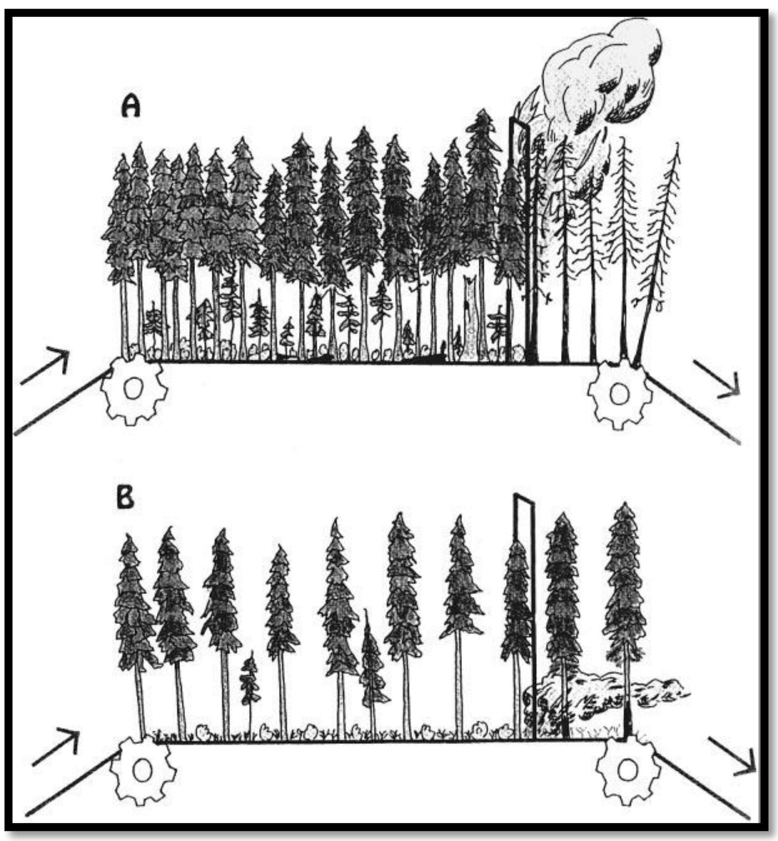


Figure 4.1-11 Critical conditions for mass flow rate can be visualized by passing a forest along a `conveyor belt' through a stationary flaming front. (A) Under severe fire weather and high rate of spread, crown mass passes through the flaming front rapidly and exceeds a critical mass flow rate, and crown fire occurs. (B) Where crown bulk density is lower under the same rate of spread, critical levels of mass flow rate cannot be obtained and the fire remains a surface fire. Lower crown fire rate of spread (i.e., lower wind speed), might also result in loss of crown fire activity. (Agee et al. 2000).

Under the VTP, the Fuel Breaks treatment area overlaps the WUI and the Ecological Restoration treatments. In most cases fuel reduction will occur along strategic topographic locations and adjacent to public roads, but it can also occur next to areas naturally low in fuel (rocky outcrops) or high moisture vegetation (wet meadows). These areas are typically referred to as anchor points and help establish the effectiveness of a fuel break. As with all projects implemented under this Program, Fuel Break treatment areas are required to be identified in the Unit Fire Management Plan, which is updated annually.

Fuel breaks fall into the same logic and application of larger, non-linear treatments such as those designed for larger landscape fuel reduction goals. The focus is to redistribute fire risk throughout the landscape by altering fire behavior. Two ways to accomplish this is to alter the rate at which fire spreads or reduce the potential for crowning fires (Cochrane et al., 2012). Effective strategies include reducing surface fuels; increasing the height of the live crown, general reductions to canopy continuity, and reduction of canopy bulk density (Russell et al., 2010). Although the fuel break treatment is linear, it can be used to accomplish these tasks while allowing the appropriate fire suppression resources the opportunity to stop the spread of the fire.

Fuel breaks can also be used to protect other natural resource values. It is often identified that prescribed fire is used to reduce the threat of future wildfires. It is generally considered a cost effective tool to treat large areas. Although mechanical applications along with manual treatments can also achieve similar results they are usually higher in cost and consequently treat fewer acres. In addition, studies have started to show that some chaparral communities have a complex ecosystem with a unique fire regime (Keeley and Brennan, 2012). Land managers in southern California should recognize the need to balance fuel treatments and ecological restoration. Depending on the fire return interval, effects on the native plant communities and condition classes it may be best to provide a fuel break in lieu of prescribed fire, mechanical or manual landscape treatments. Burn prescriptions need to balance burning hot enough to stimulate seed germination but not denude the area and risk high erosion (Beyers and Wakeman, 2000). Likewise, activities including mastication, hand cutting or herbicides across a landscape may have a reduced long-term effectiveness due to the presence of seed in the soil (Cochrane et al., 2012). Consequently, protecting an area with fuel breaks for continued ecological values may be an advantage as an alternative to the landscape approach (Graham et al, 2010).

Figure 4.1-12 Non-shaded fuel break

Description of Fuel Break treatment terminology

Non-Shaded Fuel Break - A fuel break without shade normally comprises a change in vegetation type, such as from forest or shrubland into grassland. Since a large opening is essentially cleared of woody vegetation to create a non-shaded fuel break, heavy equipment is typically used for construction, except on steep slopes, where manual or prescribed fire treatments are employed (Figure 4.1-12).

Shaded Fuel Break - A shaded fuel break is constructed in a forest setting. Typically, the tree canopy is thinned to reduce the potential for a crown fire to move through the canopy. The woody understory vegetation is likewise thinned out, and in certain situations is eliminated. The shade of the retained canopy helps reduce the potential for rapid re-growth of shrubs and sprouting hardwoods and can reduce rill and gully erosion (Figure 4.1-13).

Figure 4.1-13 Before and after shaded fuel break construction

Both shaded and non-shaded fuel breaks are constructed using a mix of treatments, such as uprooting vegetation using a tractor blade (preferably a comb-like “brush blade”) or severing vegetation at the root line manually with a chainsaw. Thinning of the canopy may allow for harvest of merchantable and non-merchantable timber. Mastication (grinding into small pieces using a large grinding head mounted on a piece of heavy equipment) may be used to thin understory vegetation. Slash created by fuel break installation can be treated by removal from the fuel break area, piling and burning, mastication, chipping or lopping and scattering. Fuel breaks can be maintained by a repeat of the treatments that were used for construction or by a different treatment, such as prescribed fire, herbivory, or the use of herbicides.

For the purposes of this VTP Program EIR the fuel break treatment modeling exercise includes a 150 foot buffer (along each side of the linear feature for a 300 foot total treatment width) along ridgelines identified by the Environmental Systems Research Institute (Esri) ridgeline modeling process and recognized standard street-mapped roads within the state. Then SRA, WUI, and Condition Classes 2 and 3 areas were selected. The acreage results and coverage area are outlined in Tables 4.1-22 and Figure 4.1-14. The 150 foot treatment area was a baseline for the model; depending on the local application of the Program this width may vary. It is highly unlikely that all modeled areas will be treated as fuel breaks due to possible environmental constraints, local political concerns, and dependence of outside funding.

The Sierra Nevada Bioregion has the highest potential area available for fuel break treatments while the San Joaquin and Colorado Desert areas have the lowest. Reviewing the vegetation types within the fuel break treatments indicate that the southern areas of the state have a high brush dominated component for potential fuel breaks while the Central Coast leans heavy towards grass fuel break models and the Klamath/North Coast zone lean towards tree dominated areas (Tables 4.1-18 and 4.1-19).

Table 4.1-18 Fuel Break acres by Bioregions

Bioregion	Fuel Breaks	% of Area within Total VTP Acreage
Bay Area/Delta	357,587	12%
Central Coast	511,340	11%
Colorado Desert	227,851	16%
Klamath/North Coast	868,110	12%
Modoc	440,614	15%
Mojave	709,593	22%
Sacramento Valley	200,810	13%
San Joaquin Valley	291,663	13%
Sierra Nevada	523,617	9%
South Coast	405,051	19%
Totals	**4,536,236**	**13%**

Table 4.1-19 Fuel Break acres by Bioregions and vegetation type

Bioregion	Tree Dominated	Shrub Dominated	Grass Dominated	Total by Bioregion
Bay Area/Delta	108,736	56,220	192,632	**357,587**
Central Coast	11,457	108,344	391,538	**511,340**
Colorado Desert	9,328	217,758	764	**227,851**
Klamath/North Coast	608,831	93,706	165,573	**868,110**
Modoc	235,654	162,586	42,375	**440,614**
Mojave	26,068	667,615	15,910	**709,593**
Sacramento Valley	10,156	2,304	188,351	**200,810**
San Joaquin Valley	5,105	20,580	265,978	**291,663**
Sierra Nevada	203,453	91,159	229,006	**523,617**
South Coast	35,727	294,694	74,630	**405,051**
Total by Veg Type	**1,254,514**	**1,714,965**	**1,566,758**	**4,536,236**

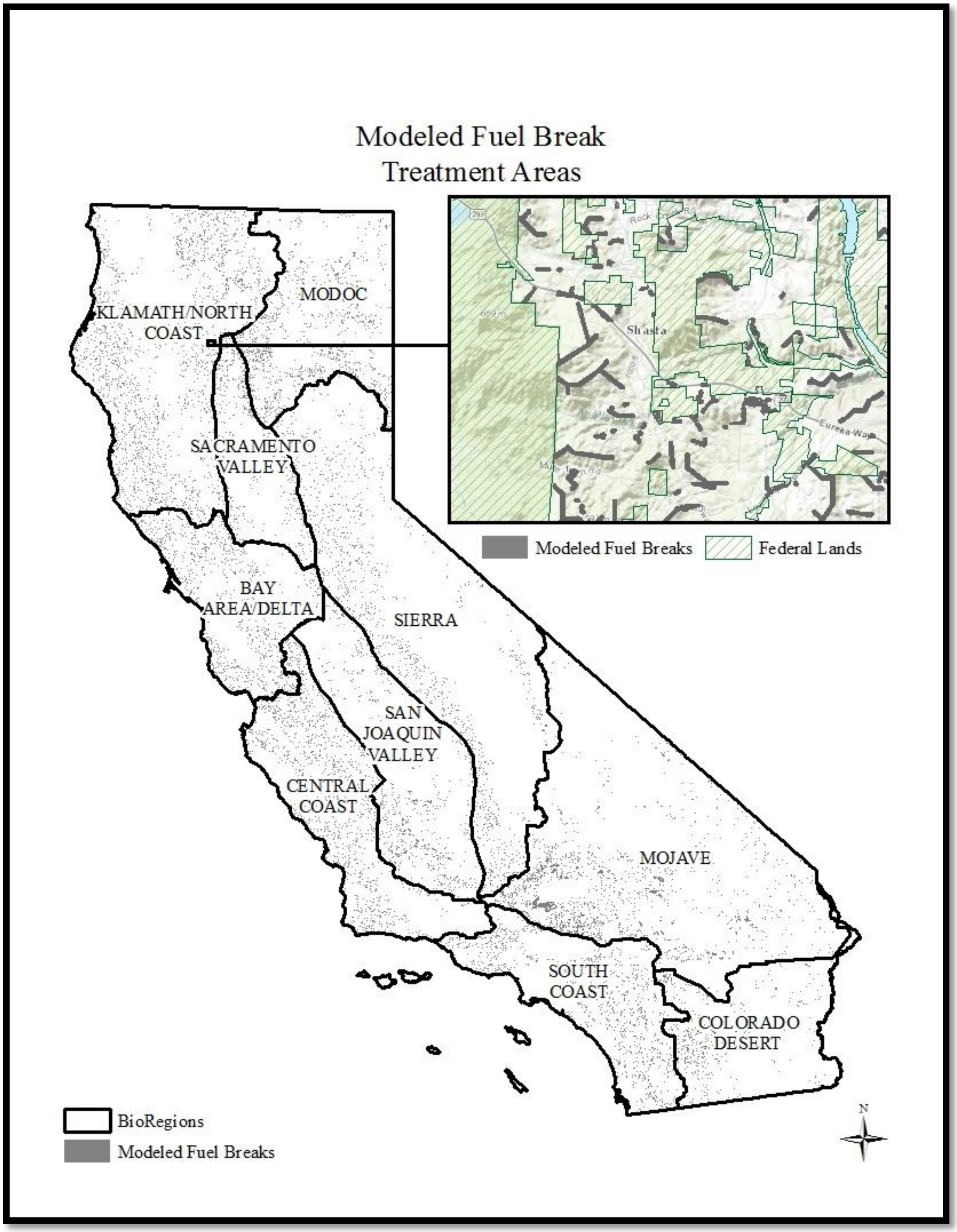


Figure 4.1-14 Areas subject to the Fuel Break treatment within California

4.1.5 ACTIVITY CONSIDERATIONS AT THE PROJECT LEVEL

This section continues a more detailed review of the Activities described in Chapter 2.2 outlined in Table 2.2-3. Activity Treatments include prescribed fire, mechanical, manual, herbivory and herbicides

4.1.5.1 Prescribed Fire Treatments

Prescribed fire is the intentional application of fire to fuels under specified conditions of fuels, weather, and other variables. The intent is for the fire to stay within a predetermined area to achieve site-specific resource management objectives. A focus on prescribed low intensity surface fires may be used to control vegetation by enhancing the growth, reproduction, or vigor of certain species, in addition to managing fuel loads and/or maintaining a targeted vegetation community. In addition, prescribed fires can be used to restore the ecological function in areas that have departed from the natural fire regime (Van Wagtendonk and Lutz, 2007). Burning may be used prior to or after other treatments, including herbicide applications, to enhance the effectiveness of those treatments.

Factors considered when designing and implementing a prescribed burn include risk to dwellings and property, land use, cultural resources, threatened and endangered species, potential impacts on air and water quality, soil stability, weather conditions, slope and aspect, soil type, vegetation types and density, fuel moisture content, time of year and alternative treatment methods.

Pile burning - This tool is used to reduce areas of heavy concentrations of surface fuels. This technique involves gathering concentrations of fuel into a pile, igniting it and limiting the fire to each individual pile at a time. Burning of slash piles created by either tractors or by hand is a common method for treating vegetation where there are constraints that limit other types of burning. CAL FIRE’s VTP pile burning activities may also be coupled with other programs (e.g. greenhouse gas reduction funding) where piled materials may be shipped to a biomass/bioenergy facility.

Prescribed fires – Prescribed fire can be classified into various types including broadcast burns, underburning and jackpot burning.

Broadcast burns – Broadcast burns are usually done on small to moderately large areas to:

- Improve browse or forage for wildlife or domestic stock
- Create fuel breaks
- Control invasive and noxious weeds

- Treat slash in areas cleared of dead and/or live fuels.

Underburn – This is a variation of the broadcast burn and is focused on treating surface or ladder fuels in a shaded fuel break setting to manage understory vegetation for various objectives such as wildlife habitat improvement or for production of cultural plants important to Native Americans.

Jackpot burning – This involves burning the larger concentrations of fuel and allowing the fire to work its way through the unit.

Burning may occur throughout the year, however it is usually conducted during late spring when the ground is still wet or during the fall or winter when precipitation is imminent and after plants have completed their yearly growth cycle and their moisture content has declined. Spring burns are preferred by CAL FIRE staff to ensure a greater measure of public safety. However, there may be other impacts such as interruptions to animal and plant reproduction activities. Fall burns tend to be more closely aligned with the natural fire cycle found in California. Some broadcast burning in grasslands may be done in May, after the annual grasses have cured. Piles of vegetation are available to be burned after the vegetation has dried. Within brush or chaparral communities this may not be a desired treatment method due to the possible impacts of high fire intensities. Furthermore, some chaparral community species may benefit from spring burns in order to help germinate seed while other species may benefit from fall sprouting (Beyers and Wakeman, 2000). Chaparral communities will have to be evaluated on a case by case basis to determine if this will be a viable tool.

Based on a specific project's objectives, fuel modeling and environmental factors a broadcast burn can be used to treat various fuel types (1 hour, 10 hour, or 100 hour fuels). "Cool" burn prescriptions, using patterned lighting techniques such as backfiring, chevron burning, and flank firing, as well as timing the fires during periods of high humidity and high fuel moisture content, would be expected to result in partial removal of understory or groundcover vegetation. The existing groundcover vegetation would be partially retained in a mosaic pattern in forest and shrub communities. Fire behavior and burn severity would also depend on the properties of various fuel strata and the horizontal and vertical continuity of those strata (Graham, Jain, and Matthews, 2010).

Commonly all prescribed burns will require the construction of control lines using hand or mechanical treatments. In some cases, extensive or mature shrubs must be pretreated manually by hand crews or by mechanical equipment to remove the aerial component of the vegetation and reduce the probability of an escaped fire when the vegetation is burned. Sometimes vegetation is pretreated with herbicides to kill the aboveground portions and cause them to dry before burning.

Hand held ignition devices, such as drip torches, propane torches, diesel flame-throwers, and fusees (flares) may be used to start a prescribed fire. Area ignition apparatus include terra-torches and heli-torches (Figure 4.1-15). These apparatus release an ignited gelled fuel mixture onto the area to be treated. Helicopters may also be used to drop hollow polystyrene spheres (similar to Ping-Pong balls) containing potassium permanganate that are injected with ethylene glycol immediately before ignition. The sphere ignition method is best used for spot-firing projects.

Figure 4.1-15 Helicopter application of a prescribed burn in Southern California.

Prescribed fire may be used in some situations where other treatment methods are not feasible due to rocky soils, steep slopes, or irregular terrain; although prescribed fire is limited to situations where sufficient fuel is available and arranged properly to carry the fire. It is also generally less expensive to treat vegetation using fire ($20 to $500 per acre for grasslands, woodlands and shrublands, with higher costs associated with treating forest types). However, project planning and pre-treatment activities often increase costs dramatically.

Figure 4.1-16 Example of prescribed burning to create a fuel break. Wind is blowing in a favorable direction.

The use of prescribed fire comes with a risk of the fire burning out of control and damaging property and public improvements, endangering human life, and creating hazards from smoke. Timing of prescribed burns is dependent on specific weather conditions that are described in the burn plan prepared for the project. These weather conditions can often be difficult to meet. Thus alternative treatments, including mechanical, manual, prescribed herbivory, and herbicide, are often used to control vegetation near communities. In some situations, prescribed fire can encourage the establishment of invasive and noxious plants if the impacted area is not treated with herbicides or re-vegetated with the desired plants following the fire. Although prescribed fire can reduce fine fuels, surface vegetation, and preserve some surface organic layers including course woody debris, it requires a thorough management plan.

Any prescribed burn project under the Program shall require a burn plan that includes a map(s) with the project boundaries, a description of the location and objectives of the project, a prescription describing the required weather conditions, fuel moisture, and soil and duff moisture, desired fire behavior, a public information plan, and a smoke management plan (see Appendix J for an example of a burn plan). The smoke management plan identifies the affected Air Pollution Control District(s) or Air Quality Management District(s), smoke-sensitive areas, wind direction, venting elevation, and visibility factors required to disperse the smoke. The smoke management plan is designed to minimize public exposure to air pollutants generated by prescribed burns. Burning must adhere to local and state regulations and laws. In some cases the local Air Resources Control District may be consulted for special requirements for prescribed fires.

4.1.5.2 Mechanical Treatments

Mechanical treatments involve the use of motorized equipment (rather than labor intensive hand work), such as wheeled tractors, crawler-type tractors, or specially designed vehicles with attached implements designed to cut, uproot, crush/compact, or chop existing vegetation. The selection of a particular mechanical treatment and equipment is based upon a number of factors, such as characteristics of the vegetation, seedbed preparation and re-

Figure 4.1-17 Mastication may be used to reduce the horizontal and vertical continuity of fuels.

vegetation needs, topography and terrain, soil characteristics, climatic conditions, and a comparison of the improvement cost to the expected increase in productivity or public and/or private benefit. In some cases, mechanical treatments can create a desired stand structure and composition where prescribed fire will not duplicate the intent due to possible risks and uncertainties with its use. Mechanical methods that may be used include tilling, drill seeding, mowing, masticating, grubbing, chaining, feller-bunching, and chippers (Table 4.1-20). In addition, these mechanical treatments often require that the manipulated vegetation requires a secondary treatment such as pile burning or chipping. The use of machines can create and maintain a desired forest floor condition in various settings, however if they are used improperly they can displace mineral soil and reduce organic content (Graham, Jain, and Matthews, 2010). As new technologies and techniques are developed, they may be used if their impacts are similar to or less than those discussed below.

Mechanical treatments are effective for removing dense stands of vegetation. Some mechanical equipment can masticate (mulch) or lop and scatter vegetative debris concurrently with vegetation removal (Figures 4.1-18 and 4.1-19). Mechanical methods are appropriate where a high level of control over vegetation removal is needed, such as near home sites, communities, or in sensitive wildlife habitats and are often used instead of prescribed fire or herbicide treatments for vegetation control in the Wildland Urban Interface (WUI). Unless used with follow-up herbicide treatments, mechanical treatments have limited use for noxious weed control, as the machinery tends to spread seeds and may not kill roots.

Figure 4.1-18 Mechanical brush removal work completed with a bulldozer. Piles are in the back ground to be treated at an appropriate

Mechanical vegetation control costs from $800 to $1200 per acre for equipment, fuel, and labor. Repeated mechanical treatments are often necessary, as residual weed or shrub seed in the soil or re-sprouting of shrubs may re-vegetate treated areas with undesired plants. Mechanical treatments tend to cost 3.5 times higher than

Figure 4.1-19 Ball and chain being towed behind a bulldozer.

prescribed burns due to the removal requirements of non-commercial biomass (North, Collins, and Stephens, 2012).

Mechanical treatments are generally conducted when soils are not saturated with water to prevent soil compaction, excessive damage to dirt roads, or increased erosion and sedimentation into streams. In general, most mechanical treatments occur in late spring, summer, or fall (May 1 to November 15). These treatments are frequently used to install control lines for prescribed burns, to pretreat vegetation for subsequent burning, or as a stand-alone treatment. Disking may be used to uproot herbaceous vegetation and is usually done in late spring or early summer after the grasses and herbaceous vegetation have cured. Bulldozers can crush or uproot shrubs with a straight blade or brushrake. Rotary head cutters on articulated booms are effective at cutting shrubs and trees less than 22 inches in diameter at breast height (4½ feet above the ground). See Figure 4.1-20 & 4.1-21.

Figure 4.1-20 Feller buncher with a rotary head cutter on an articulated boom.

Figure 4.1-21 Another view of a Feller buncher with a rotary head cutter on a articulated boom.

It is anticipated that some material generated by the Program might be removed to a biomass plant concurrent with Program operation. Because the cost to remove such fuel is high, it is anticipated that no more than 10% of mechanical treatments might generate useable biomass, and only then when the material is chipped on site and only when the projects are near an existing biomass plant.

Removal of forest trees for commercial purposes will require additional CEQA review. These projects would require a timber harvesting plan (THP), non-industrial timber management plan (NTMP), or some other program timber harvesting plan (PTHP).

Table 4.1-20 Variations in Mechanical Activity Techniques

Mechanical Activities	Description
Tilling	Involves the use of angled disks (disk tilling) or pointed metal-toothed implements (chisel plowing) to uproot, chop, and mulch vegetation. This technique is best used in situations where complete removal of vegetation or thinning is desired, and in conjunction with seeding operations. Tilling leaves mulched vegetation near the soil surface, which encourages the growth of newly planted seeds. Tilling is usually done with a brushland plow, a single axle with an arrangement of angle disks that covers about 10-foot swaths. Sometimes a crawler-type tractor or a large rubber-tired tractor pulls an offset disk plow, which consists of multiple rows of disks set at different angles to each other. This method is often used for removal of sagebrush and similar shrubs and works best on areas with smooth terrain and deep, rock-free soils. Chisel plowing can be used to break up compacted soils, such as hardpan.
Drill Seeding and Drilling	Is often done in conjunction with tilling. The seed drills, which consist of a series of furrow openers, seed metering devices, seed hoppers, and seed covering devices, are either towed by or mounted on a tractor. The seed drill opens a furrow in the seedbed, deposits a measured amount of seed into the furrow, and closes the furrow to cover the seed. Seed may also be injected into the soil directly through direct “drilling” without creating furrows.
Mowing	Tools, such as rotary mowers on wheeled tractors or other equipment, or straight-edged cutter bar mowers, can be used to cut herbaceous and woody vegetation above the ground. Mowing is often done along highway right-of-ways to reduce fire hazards, improve visibility, prevent snow buildup, or improve the appearance of the area. Mowing is also used in sagebrush habitats to create a mosaic of uneven-aged stands and enhance wildlife habitat. Mowing is most effective on annual and biennial plants. Mowing rarely kills weeds, so an area may have to be mowed repeatedly for the treatment to be effective. However, the use of a “wet blade,” in which an herbicide flows along the mower blade and is applied directly to the cut surface of the treated plant, has greatly improved the control of some species. In addition, chipping equipment can be used to cut and chip vegetation.
Masticating	Equipment installed on small wheeled tractors, wheeled or crawler-type tractors, excavators, or other specialized vehicles, is used to cut shrubs and trees into small pieces that are scattered across the ground, where they act as mulch (Figure 2.4-3). Shrubs and sapling-size trees are typically masticated with small-wheeled tractors and crawler-type tractors, while excavators are often used when larger trees are removed. Small-wheeled tractors generally operate on slopes less than 20% while excavators and tractors can operate on slopes up to 45%.
Grubbing/ Ripping	This is usually done with a crawler-type tractor and a brush or root rake attachment. The rake attachment consists of a standard dozer blade adapted with a row of curved teeth projecting forward at the base of the blade. Shrubs are uprooted and roots are combed from the soil by placing the base of the blade below the soil surface. Grubbing significantly disturbs surface soil horizons and perennial grasses and forbs, so grubbed areas are usually reseeded with desired species to prevent extensive runoff and erosion. Runoff and erosion on steeper slopes and/or more erosive soils can be greatly reduced by pushing shrubs into windrows on contours across the slope. These windrows can be burned, or left in place to become wildlife habitat as they gradually decompose through natural processes. In some cases the grubbing or ripping technique can also pile the vegetation material for pile burning.
Feller-bunchers	Are often used within a commercial or pre-commercial thinning or partial cutting for fuel hazard reduction projects such as shaded fuel breaks and wildlife habitat improvement. Feller-bunchers and harvester-forwarder-processors are used primarily east and northeast of the Central Valley, on slopes of less than 35%, and for handling trees that are between 4-22 inches in diameter. Feller-bunchers clamp the trunks of trees, cut them at the base, pick them up, and bundle them into piles or load them onto trucks. Rubber-tired skidders or crawler tractors equipped with grapples skid the piles to landings, where they are processed.
Chipping	Chippers or “tub-grinders” are often used to chip the tops and limbs to generate mulch or biomass, which can be used onsite, sold to homeowners or garden supply stores, or used in power generation facilities.
Chaining	Consists of pulling heavy (40 to 90 pounds per link) chains in a “U” or “J” shaped pattern behind two crawler-type tractors, or by one tractor pulling a chain with a heavy ball attached to the end. Chaining is most effective for crushing brittle shrubs, such as manzanita and chamise, and uprooting woody plants. Chaining can be done on irregular, moderately rocky terrain, with slopes of up to 50%. Although chaining may cause soil disturbance, the resultant plant debris can be left in place to minimize surface erosion, shade the ground surface, maintain soil moisture and provide nutrient recycling. Alternatively, the debris can be burned to facilitate grass seeding, improve aesthetic values, and eliminate potential rodent habitat. Chaining is a cost effective means to incorporate grass seed into soil, especially in burned areas, as it provides a variety of seeding depths and microsites, which can improve ground cover and forage production.

4.1.5.3 **Manual Treatments**

Manual treatment involves the use of hand tools and hand-operated power tools to cut, clear, or prune herbaceous and woody species. Treatments include:

- Thinning trees with chainsaws, loppers, or pruners
- Cutting undesired competing brush species above ground level to favor desirable species and spacing
- Pulling, grubbing, or digging out root systems of undesired plants to prevent sprouting and regrowth
- Placing mulch around desired vegetation to limit competitive growth

Hand tools used in manual treatments include the handsaw, axe, shovel, rake, machete, grubbing hoe, mattock (combination of cutting edge and grubbing hoe), pulaski (combination of axe and grubbing hoe), brush hook, hand pruners, and pole pruning saws. Power tools, such as chain saws, power brush saws, and power pruning saws, are also used, particularly for thick-stemmed plants and thick limbs.

Manual treatments, such as hand pulling and hoeing, are most effective where weed infestations are limited and soil types allow for complete removal of plant material (Figure 4.1-22). Pulling works well for annual and biennial plants, shallow-rooted plant species that do not re-sprout from residual roots, and plants growing in sandy or gravelly soils. Repeated treatments are often necessary due to soil disturbance and residual weed seeds in the soil.

Accumulation of vegetation created by manual treatments is typically treated by:

- Lopping to a specified maximum length and scattered within treatment boundary to reduce flame lengths in the event of a fire
- Piling by hand and burning during wet periods of the year
- Piling and leaving piles unburned for wildlife habitat
- Chipping, with the chips blown onto the ground or into piles for later removal
- Cutting tree trunks into lengths for firewood gatherers
- Removing tree trunks by hand for utilization

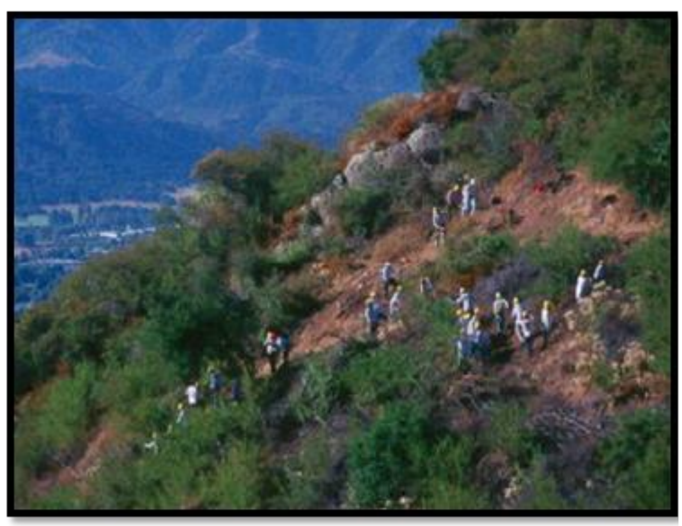


Figure 4.1-22 Manual construction of a fuel break.

Manual techniques can be used in many areas and usually with minimal environmental impacts. Although they may have limited value for weed control over a large area, manual techniques are highly selective. Manual treatment is effectively used in sensitive habitats, such as riparian areas and wet areas, areas where burning or herbicide application would not be appropriate, to install control lines for prescribed burns where mechanical equipment cannot be used, around structures, and in areas that are inaccessible to vehicles. In addition, ground disturbance is lower compared to mechanical treatments.

Manual treatments are expensive and labor intensive compared to other vegetation management methods, such as prescribed burning and herbicide application. Typical manual vegetation control costs have ranged from $70 to $1200 per acre (Metz, pers. comm., 2006) to upwards of $2,200/acre in the Logtown (El Dorado County) community assistance grant. Manual methods may also be more dangerous for the workers involved in implementation due to the use of various cutting tools, steep terrain, and other adverse conditions. While manual techniques may not be efficient or cost effective over large acreages, they may be useful for targeting specific invasive species, minimizing impacts to desirable species, and for educating public land managers. Manual methods may also be cost effective for small-scale projects where heavy equipment move in/out costs are prohibitive.

4.1.5.4 Prescribed Herbivory Treatments

Prescribed herbivory treatments involve the intentional use of domestic livestock. Prescribed herbivory treatments are used to reduce the targeted plant population to an acceptable level by stressing target plants and reducing competition with the desired plant species.

Domestic livestock, such as cattle, horses, sheep, or goats, control the top-growth of certain non-native invasive and noxious weeds, which can help to weaken the plants and reduce the reproduction potential (Figure 4.1-23). The animal's benefit by using the weeds as a food source and can, after a brief adjustment period, consume 50 percent or more of their daily diet of the

Figure 4.1-23 Use of goats to reduce competing vegetation.

weed, depending on the animal and plant species.

Cattle and horses primarily eat grass, and occasionally cattle also eat some shrubs and forbs. Sheep consume many forbs, as well as grasses and shrubs, but tend not to graze an area uniformly. Goats typically eat large quantities of woody vegetation as well as forbs and tend to eat a greater variety of plants than sheep. Goats and sheep are effective control agents for leafy spurge, Russian knapweed, toadflax, other weed species, and some types of shrubs. In addition, goats tend to be good at controlling young regrowth such as vegetation on cleared fuel breaks but they become increasingly selective as shrubs age. However they do provide a possible alternative to herbicides (Conrad, Roby, and Hunter, 1986).

A successful treatment program can enhance habitat for wildlife. For example, cattle, horses, and sheep feeding in the spring and early summer can thin understory forbs and grasses, reducing competition for light, nutrients, and water for desirable shrub species. The shrub species will then increase their vegetative output for winter browsing by deer and other wildlife.

In order for this treatment to be effective, the right combination of animals, stocking rates, timing, and rest must be used. Prescribed herbivory by domestic animals should occur when the target species is (are) palatable and when feeding on the plants can damage them or reduce viable seeds. Additionally, prescribed herbivory should be restricted during critical growth stages of desirable competing species. When desirable species are present, there needs to be adequate rest following the treatment to allow the desirable species to recover.

Whenever the use of livestock to control undesirable vegetation is being considered, the needs of the domestic animals as well as the other multiple use objectives for the area must be considered. A herder, fencing, mineral block, and/or a watering site may be required to keep the animals within the desired area. Many weed species are less palatable than desired vegetation, so the animals may overgraze desired vegetation rather than the weeds. Additionally, some weeds may be toxic to certain livestock and not to others, which will influence the management option selected. Proper management of the domestic animals is extremely important if this method of treatment is to be successful.

Caution should be used whenever prescribed herbivory or any other vegetation control is prescribed near riparian areas and wet areas, in steep topography, or in areas with highly erodible soils. Weed seeds may still be viable after passing through the digestive tract of animals, so the animals should not be moved to weed-free areas until ample time has passed for all seeds to pass through their systems. Seeds can also travel on the wool or hair of domestic stock. Typical prescribed herbivory costs range from $500 to $1200 per acre.

4.1.5.5 Herbicide Treatments

Herbicides are chemicals that damage or kill plants. Herbicides can be classified by their mode of action and include growth regulators, amino acid inhibitors, grass meristem destroyers, cell membrane destroyers, root and shoot inhibitors, and amino acid derivatives, all of which interfere with plant metabolism in a variety of ways.

Herbicides can also be categorized as selective or non-selective. Selective herbicides kill only a specific type of plant, such as broad-leaved plants. Some herbicides used for noxious weed control are selective for broad-leaved plants, so that they can be used to control weeds while maintaining grass species. Other herbicides, such as glyphosate (Roundup®) are non-selective, so must be used carefully around non-target plants. Typical herbicides likely to be applied include, but are not limited to:

- Glyphosate (Isopropylamine Salt, Potassium Salt, & Diammonium Salt)
- Hexazinone
- Imazapyr (Isopropylamine Salt)
- Triclopyr (Butoxyethyl Ester & Triethylamine Salt)
- Clopyralid (Monoethanolamine Salt)
- Sulfometuron Methyl

Herbicide treatments legally must comply with the U.S. Environmental Protection Agency (EPA) label directions as well as California Environmental Protection Agency and Department of Pesticide Regulation (CDPR) label standards. Several herbicide application methods are available. The application method chosen depends upon an Integrated Pest Management (IPM) analysis, which includes an analysis of the:

1. Treatment objective (removal or reduction)
2. Accessibility, topography, and size of the treatment area
3. Characteristics of the target species and the desired vegetation cover
4. Location of sensitive areas and potential environmental impacts in the immediate vicinity
5. Anticipated costs and equipment limitations
6. Meteorological, vegetative, and soil conditions of the treatment area at the time of treatment
7. Proximity of human habitation

Herbicide recommendations are developed and updated for each herbicide project, generally by a licensed pest control adviser. The plan includes project specifications, key personnel responsibilities, communication procedures, safety, spill response, and emergency procedures. The plan also specifies minimum buffer widths between treatment areas and water bodies when using herbicides not approved for aquatic use.

Herbicides will not be applied within WLPZs or ELZs. All herbicides shall be handled, applied, and disposed of in accordance with the material safety data sheet (MSDS) Fact Sheet and all local, state, and federal laws.

New chemical products and formulations are likely to become available to land managers in the future. Use of one or more of these products may be deemed more desirable for particular vegetation treatment goals than currently available chemicals. New products may be more efficacious at lower application rates or lower active ingredient (a.i.) rates, be less toxic or mobile, have fewer non-target effects, be cheaper, etc. Following is a brief summary of the protocol that will be used to evaluate new products for use:

New chemicals would first have to be registered for the anticipated use under the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) by the U.S. EPA. This registration would be backed by toxicological, environmental fate, and ecotoxicity data submitted by the pesticide manufacturer and reviewed by the U.S. EPA. Re-registration by the US EPA of active ingredients and products “that were originally registered before current scientific and regulatory standards were formally established” is also required to evaluate any new information and modify registrations, labels, and tolerances, as necessary (EXTOXNET, “Pesticide Regulation”, 2001). This data is used to assess the potential human health and ecological risks from use of the chemicals.

Before new products are registered for use in California, they would have to be registered by the CDPR, which could add further label restrictions.

The potential use of new herbicides or fungicides in the VTP would require a review to ensure compliance with CEQA. The process would include a review of relevant CEQA (VTP Program EIR and other state agency Program EIRs) and NEPA (USFS, BLM, USFWS and other federal agency Environmental Assessments or Programmatic Environmental Impact Statements) documents, to determine whether any have fully covered the use of the proposed new chemical(s). The review will determine the potential human health and ecological risks of the new chemical’s use, by addressing the following criteria:

- Identification of potential use patterns, including target plants, formulation, application methods, locations to be treated, application rate, and anticipated frequency of use.
- Review of chemical hazards relevant to the human health risk assessment, including systemic and reproductive effects, skin and eye irritation, allergic hypersensitivity, carcinogenicity, dermal absorption, eurotoxicity, immunotoxicity, and endocrine disruption.
- Estimation of exposure to workers applying the chemical or reentering a treated area.

- Environmental fate and transport, including drift, leaching to groundwater, and runoff to surface streams and ponds.
- Estimation of exposure to members of the public.
- Review of available ecotoxicity data, including hazards to mammals, birds, reptiles, amphibians, fish, and aquatic invertebrates.
- Estimation of exposure to terrestrial and aquatic wildlife species.
- Characterization of risk to human health and wildlife.

Herbicides will only be applied on the ground from equipment on vehicles (including all-terrain vehicles and tractors) or by manual application devices (Figure 4.1-24). Herbicides may be applied to green leaves with a backpack applicator or spray bottle, wick (wiped on), or wand (sprayed on) or applied as pellets to the ground surface. Herbicides can also be applied to trees around the circumference of the trunk on the intact bark (basal bark), to cuts in the trunk or stem (frill, or "hack and squirt"), to cut stems and stumps (cut stump), or injected into the inner bark.

No aerial applications will be approved or funded under the Proposed Program.

Herbicides can be used selectively to control specific types of vegetation or non-selectively to clear all vegetation on a particular area. Herbicides can be applied over large areas and in remote locations, or applied using spot applications in environmentally sensitive areas. The cost of herbicide application generally ranges from $20 to $250 per acre.

There are several drawbacks and limitations to herbicide use. Herbicides can damage or kill non-target plants. Weeds may develop a resistance to a particular herbicide over time. Herbicides or their adjuvants at sufficient dosages can be toxic or cause health problems in humans, animals, birds, amphibians, reptiles, insects, and fish. Many of these limitations are offset by requirements that apply to application methodology, regulatory requirements (e.g. requirement to have a licensed Pest Control Advisor (PCA) involved in the project, etc.) label restrictions, and project specific guidelines.

Figure 4.1-24 Herbicide application

Restricted use herbicides must be applied according to written recommendations from a licensed PCA according to the label and by an herbicide applicator certified by CDPR. Permits to apply restricted herbicides are issued by County Agricultural Commissioners (CACs).

Since permits are the functional equivalent of CEQA, they must be site and time specific. Site specificity is achieved by a clear description of the site when the permit is issued. Since permits are issued for a 12- or 24-month period, time-specificity is achieved by having the permittee file a “notice of intent” (NOI) to apply the herbicide at least 24 hours before the scheduled application. The notice must describe the site to be treated and the herbicides to be applied. It must also contain information on any changes in the environmental setting (for example, construction of residences or schools or changes in vegetation cover types that may have occurred since the permit was issued). This notice allows the CAC an additional opportunity to review the planned application and apply additional restrictions if needed.

County Agricultural Commissioners may also issue multi-year permits for perennial agricultural plantings (such as fruit trees or grapevines), non-production agricultural sites, and non-agricultural sites. However, the permittee must immediately notify the CAC of any changes in the information on the permit (such as a change in the kind of crops planted, or a newly constructed labor camp or home nearby). County staff review notices of intent and can halt the proposed application if conditions warrant. County staff makes pre-application inspections on at least five percent of the use sites identified by permits or notices of intent. These are primarily spot checks to ensure that information contained on the permit is accurate.

4.1.5.6 **Treatment Combinations**

Although the aforementioned treatment types are described individually, they are typically implemented in combination. For example, the average prescribed burn of 260 acres requires up to 2.5 miles of fire line, which can result in as many as 11 of the 260 acres being cleared by heavy equipment for use as control lines. Manual treatments that do not involve the use of a chipper are often accompanied by slash pile burning the winter after treatment. For analysis purposes, projects that require multiple treatments, whether in the same year or in a following year, will have each treatment accounted for separately. Thus, a prescribed fire might require burning 260 acres and conducting 11 acres of mechanical treatment, which for the purpose of analyzing the environmental effects of treatments in this Program EIR is treated as 271 acres, even though the project acreage documented in CAL FIRE accomplishment reports would only be 260 acres. The combined treatments will also have to be described in detail within the project under this Program EIR and addressed through the environmental Project Scale Analysis (Appendix J).

4.1.5.7 **Treatment Maintenance**

Most treatments require maintenance, usually within three to twenty-five years after the original treatment (BLM, 2005). In general, shrub vegetation types would be treated on a 5-10 year rotation, or occasionally on rotations as long as 20 to 25 years, which would allow enough time for dead material to collect in order to sustain a prescribed fire. Treatments in conifer vegetation types might initially involve mechanical or hand treatment to reduce surface and ladder fuels. Following the initial treatment, prescribed fire could be used at 10 to 15 year intervals to maintain low fuel hazards. Maintenance treatment intervals are generally related to the vegetation life form, landscape location (e.g. climate and soil types influence plant regrowth) and to treatment type. For analysis purposes, and given no other significant site disturbance such as wildfire, maintenance is assumed to occur at the following time intervals:

- Grasslands – 2-5 years after previous treatment
- Shrublands – 5-10 years after previous treatment
- Forestlands – 10-15 years after previous treatment

Research by Finney indicates that not all acres need to be retreated in order to achieve changes in wildland fire behavior (Finney, 2001; Finney & McHugh, 2005). In addition, because the VTP is based on willing landowner participation, not every acre initially treated will receive a maintenance treatment.

Vegetation communities are dynamic and fuel treatments should change over time and space. Often the maintenance treatment is different than the original treatment, such as a prescribed burn followed by herbicide application(s) to control shrub regrowth, or hand treatment using chainsaws to create shaded fuel breaks along public roads followed by periodic underburning to keep sprouting and fuel loads low. Maintenance treatments can often be conducted with fewer adverse environmental effects than the original treatment. Initial treatments are not likely to include many herbicide treatments, however many of the maintenance treatments are expected to utilize herbicides.

4.1.6 BIOREGION OVERVIEW

For the purpose of this analysis, California was broken down into ten bioregions (See Figure 2.2-1 in Chapter 2). This provided a structure to allow the Program EIR to address the variability with California. The bioregion terminology was originally drafted from those used by the California Biodiversity Council Website in 2010. They are similar to the Baileys Ecoregions concepts. See Appendix A for a more specific Bioregion review.

4.1.7 ANALYSIS SUMMARY

The distribution of treatments in the Proposed Program is described in Chapter 2.3. Table 4.1-21 identifies the possible number of VTP projects by activity type (as described in Chapter 2.3 and 4.1.5) that would occur in each bioregion. It is important to note that these values are projections and are based on the relative application within the bioregions, vegetation types and treatment focus. These values are provided to allow the review and application of this Program's impacts. They are not considered upper limits of activity but more closely resemble the potential activity within the scope of this Program EIR with optimal funding and staffing needs. As stated in Chapter 2, the application and true acres treated will depend on landowner interest and available funding.

Over a ten year period it is estimated that there will be 2,308 projects implemented (Table 4.2-21). This estimate amounts to approximately 231 projects per year. The lowest volume of projects is expected to be within herbicide application (estimated 21 projects per year) while the highest will potentially be prescribed fire (estimated 122 acres per year). Applying these projects into the Vegetation types and Treatment categories provide another view of the potential application of this VTP. The majority of WUI, Fuel Breaks, and Ecological Restoration Treatments project would focus on grass and tree dominated vegetation types (Table 2.3-8).

Table 4.1-21 10 year estimate of projects within each Bioregion by activity type

Bioregions	# of Projects per Decade	RX Burn	Mechanical	Manual	Herbicides	Herbivory
Bay Area/Delta	222	111	44	22	22	22
Central Coast	299	150	60	30	30	30
Colorado Desert	41	20	8	4	4	4
Klamath/North Coast	565	283	113	57	57	57
Modoc	267	133	53	27	27	27
Mojave	101	50	20	10	10	10
Sacramento Valley	84	42	17	8	8	8
San Joaquin Valley	69	35	14	7	7	7
Sierra Nevada	468	234	94	47	47	47
South Coast	192	96	38	19	19	19
Totals	**2,308**	**1,154**	**462**	**231**	**231**	**231**

It is important to note that some bioregions have a proportionately higher number of acres treated annually than other bioregions; the Bay Area/Delta and Sacramento Valley are prime examples (Table 2.5-6). Conversely, some bioregions have a very small number of acres treated annually compared to the size of the bioregion (Modoc and Mojave in particular treat as little as 0.13 percent and 0.44 percent of all jurisdiction lands annually). The Sacramento Valley bioregion stands out as an example of a bioregion, which, based on treatment history between 2000 and 2005, annually treats about 2.0 percent of the bioregion jurisdiction lands. Part of the difference between bioregions is the fact that the VTP is based on willing landowners applying to the Program with CAL FIRE and applicants applying in much higher numbers in the Sacramento bioregion than CAL FIRE or applicants in the Modoc or Mojave bioregions. Thus the historical application rate (and the rate projected into the future) is both a matter of how aggressive the VTP coordinator within a specific CAL FIRE Unit is at soliciting landowners as well as how receptive landowners are to engaging with a state agency such as CAL FIRE.

Grouping vegetation types based on fire regime is one way to simplify the varying effects of treatment intensity based on vegetation types as shown below in Table 4.1-22. In general, vegetation types with multiple canopy layers and vertical diversity, such as coniferous forests, are adapted to a high frequency/low intensity surface/mixed fire regime and vegetation treatments tend to mimic this effect by focusing on understory treatments. On the other hand, single canopy layer vegetation types with low vertical diversity, such as grasslands and chaparral, are adapted to a low frequency/high severity crown fire regime and vegetation treatments tend to focus on crown (or overstory) level treatments. Essentially, the intensity of treatment depends on how much vegetation is left after treatment and the degree of soil disturbance.

Table 4.1-22 WHR Types by WHR Lifeform and Disturbance Type

Vegetation Subtype	Treatment/Disturbance Type	WHR Types
Hardwood	Low Intensity Treatments Surface/Mixed Fire Regimes	Aspen, Eucalyptus, Montane Hardwood, Montane Riparian, Valley Foothill Riparian
Long-Needled Conifer	Low Intensity Treatments Surface/Mixed Fire Regimes	Eastside Pine, Jeffery Pine, Klamath Mixed Conifer, Montane Hardwood-Conifer, Ponderosa Pine, Sierran Mixed Conifer, Unknown Conifer Type
Short-Needled Conifer	Low Intensity Treatments Surface/Mixed Fire Regimes	Closed-Cone Pine-Cypress, Douglas-Fir, Juniper, Lodgepole Pine, Pinyon-Juniper, Red Fir, Redwood, Subalipine Conifer, White Fir
Desert Shurbland	Low Intensity Treatments Surface/Mixed Fire Regimes	Alkakau Desert Scrub, Desert Scrub, Desert Succulent Scrub, Joshua Tree.
Grasslands	Low Intensity Treatments Surface/Mixed Fire Regimes	Blue Oak-Foothill Pine, Blue Oak Woodland, Coastal Oak Woodland, Valley Oak Woodland
	High Intensity Treatments Crown Fire Regimes	Annual Grassland, Perennial Grassland,
General Shurbland	High Intensity Treatments Crown Fire Regimes	Bitterbrush, Chamise-Reshank Chaparral, Coastal Scrub, Low Sage, Mixed Chaparral, Montane, Chaparral, Sagebrush

The intensity of each treatment type is related primarily to the techniques and tools used in that treatment type, and secondarily to the vegetation type being treated. Differences between treatment types are relatively clear, e.g., broadcast burning relies on controlled use of fire to burn vegetation while mechanical thinning relies on use of motorized equipment to remove vegetation. However, a less obvious effect results from the same treatment type being applied to different vegetation types. For example, a prescribed broadcast burn in a conifer forest will not likely affect overstory canopy closure, while the same prescribed burn in a chaparral field will likely destroy up 75 percent or more of the overstory shrub canopy.

The relative proportion of crown fire versus surface/mixed fire regime vegetation types varies significantly by bioregion, as do the number of treatments within each vegetation type. Generally, the proportion of crown fire regime vegetation in each bioregion increases as you move from Northern California to Southern California (Table 4.1-24). Thus it is likely that the intensity of treatment will increase as the proportion of crown fire vegetation in the bioregion increases. Tables 4.1-24 and 4.1-25 show the number of acres and projects treated by vegetation type annually and at the end of ten years of treatments.

Table 4.1-23 Proposed Program Potential Annual Treatments by Disturbance Type and Bioregion.

Bioregion	Total Landscape Acres in Bioregion	Surface/Mixed Fire Regimes			Crown Fire Regimes		
		Acres in Bioregion	Potentional Annual Acres Treatated in Bioregion	Potentional # of Annual Projects in Bioregion	Acres in Bioregion	Potentional Annual Acres Treatated in Bioregion	Potentional # of Annual Projects in Bioregion
Bay Area/Delta	2,399,787	945,144	2,269	9	1,443,000	3,464	13
Central Coast	3,233,677	119,561	287	1	3,106,993	7,458	29
Colorado Desert	438,483	336,041	807	3	102,674	246	1
Klamath/North Coast	6,085,627	4,713,298	11,314	44	1,381,663	3,317	13
Modoc	2,881,730	1,697,601	4,075	16	1,178,153	2,828	11
Mojave	1,089,301	445,225	1,069	4	642,975	1,543	6
Sacramento Valley	907,721	43,617	105	0	862,592	2,071	8
San Joaquin Valley	745,311	78,769	189	1	668,420	1,604	6
Sierra Nevada	5,074,695	2,747,002	6,594	25	2,299,498	5,520	21
South Coast	1,982,342	226,561	544	2	1,839,583	4,416	17
Totals	**24,838,675**	**11,352,819**	**21,282**	**105**	**13,642,668**	**39,466**	**125**

Table 4.1-24 Proposed Program Potential Treatments over 10 years by Disturbance Type and Bioregion.

Bioregion	Total Landscape Acres in Bioregion	Surface/Mixed Fire Regimes			Crown Fire Regimes		
		Acres in Bioregion	Proportion of Bioregion Treated per Decade	Potentional No. of Projects in Bioregion	Acres in Bioregion	Proportion of Bioregion Treated per Decade	Potentional No. of Projects in Bioregion
Bay Area/Delta	2,399,787	945,144	0.9%	87	1,443,000	1.44%	133
Central Coast	3,233,677	119,561	0.1%	11	3,106,993	2.31%	287
Colorado Desert	438,483	336,041	1.8%	31	102,674	0.56%	9
Klamath/North Coast	6,085,627	4,713,298	1.9%	435	1,381,663	0.54%	128
Modoc	2,881,730	1,697,601	1.4%	157	1,178,153	0.98%	109
Mojave	1,089,301	445,225	1.0%	41	642,975	1.42%	59
Sacramento Valley	907,721	43,617	0.1%	4	862,592	2.28%	80
San Joaquin Valley	745,311	78,769	0.3%	7	668,420	2.15%	62
Sierra Nevada	5,074,695	2,747,002	1.3%	254	2,299,498	1.09%	212
South Coast	1,982,342	226,561	0.3%	21	1,839,583	2.23%	170
Totals	**24,838,675**	**11,352,819**		**1,048**	**13,525,550**		**1,249**

4.2 BIOLOGICAL RESOURCES

The material presented in 4.2 has been broken into three sections:

- **4.2.1-Affected Environment**
  - The Affected Environment section discusses the biological setting in which projects may occur, special concerns present in each bioregion, and the state-wide regulatory framework that limits impacts to biological resources.
- **4.2.2-Effects**
  - The Effects section outlines the potential impacts of implementing the proposed project.
- **4.2.3-Mitigations**
  - The Mitigation section provides standard mitigations to reduce the likelihood of the proposed project causing adverse impacts to biological resources. The bioregion was determined to be the appropriate scale for this analysis because it is an area that includes a rational ecological community with characteristic physical (climate, geology), biological (vegetation, animal), and environmental conditions.

4.2.1 AFFECTED ENVIRONMENT

The following section contains a summary of the biological resources found in each Bioregion. The description of biological and environmental conditions is excerpted from the California Department of Fish and Wildlife (CDFW) Wildlife Action Plan. See CDFW web site http://www.wildlife.ca.gov to view the full report.

California is a diverse state encompassing numerous climates, topography, vegetative communities, and animal habitats. Bioregions attempt to break the state into areas of common qualities, sensitivities, species and natural processes for purposes of resource management and environmental impact analysis. These similarities allow for a reasonable analysis of the foreseeable cumulative impacts of the proposed project without being so large an area as to dilute the impacts, nor too small an area to magnify the impacts. The bioregion was determined to be the appropriate scale to analyze the impacts of the proposed Program. A focused analysis at the scale of the project is required by the Project Scale Analysis (see Appendix J) prior to implementing an individual treatment under the proposed Project. A map of the Bioregions is included as Figure 2.2-1 in Chapter 2.

4.2.1.1 **Regulatory Framework**

State agencies, including CAL FIRE, are directed through a variety of laws and regulations to protect and manage California's biological resources. These include:

<u>California Laws and Regulations:</u>

- CEQA
- California State Endangered Species Act (CESA)
- Porter-Cologne Water Quality Control Act
- Lake and Streambed Alteration (LSA) Agreement
- Native Plant Protection Act (NPPA)
- California Forest Practice Rules
- California Coastal Act

<u>Federal Laws and Regulations:</u>

- Federal Endangered Species Act (FESA)
- Migratory Bird Treaty Act
- Clean Water Act (CWA)
- Federal Coastal Acts
- Coastal Zone Management Act

CALIFORNIA ENVIRONMENTAL QUALITY ACT (CEQA)

CEQA provides that public agencies whose activities may affect the environment shall prevent environmental damage (CCR § 15000-15387). Rare threatened, or endangered plant species, subspecies, and varieties are specifically considered in various sections of CEQA (CCR §15380). CEQA Guidelines Section 15380 (b) provides the criteria for Endangered, Rare, and Threatened species. Section 15380 (d) states that species that are not on state and federal lists, but meet the criteria in subsection (b) of Section 15380, “shall nevertheless be considered to be endangered, rare or threatened.” CNPS List 1A, 1B, and 2 plant species will be initially presumed to meet these criteria subject to review and reassessment during scoping. Additionally, under Section 15380 species will be considered Endangered, Rare, or Threatened, if it is listed as such under the California or Federal Endangered Species Act (ESA). Species designated as candidates for listing by the fish and Game Commission under the CESA also are “presumed to be endangered.” The California ESA presumes that candidate species meet the criteria for listing as Endangered, Rare, or Threatened. State certified regulatory programs are subject to provisions in CEQA regarding the avoidance of significant adverse effects on the environment, including native plant communities and rare, threatened, and endangered plants, where feasible (CCR § 15250.) Public Resources Code § 21080.5(d)(2)(a) states that the rules and regulations adopted by the administering agency of a certified regulatory program shall “require that an activity will not be approved or adopted as proposed if there are feasible mitigation measures available which would substantially lessen any significant adverse effect which the activity may have on the environment.” The FPRs are a State Certified Regulatory Program (CCR § 15251 (a)) and are subject to these rules.

CALIFORNIA ENDANGERED SPECIES ACT (CESA)

The California Endangered Species Act (CESA) (Fish and Game Code § 2050-2116) was enacted in 1984 and enhanced protection for endangered, rare, and threatened species. Under CESA, “it is the policy of the state to conserve, protect, restore, and enhance any endangered species or any threatened species and its habitat” (Fish and Game Code § 2052). It is also State policy to disapprove projects that are proposed without feasible mitigation to reduce the impacts below the level of significance and that would jeopardize the continued existence of any endangered or threatened species or result in the adverse modification of habitat essential to the existence of those species (Fish and Game Code § 2053 - 2055). CESA generally parallels the main provisions of the Federal Endangered Species Act and is administered by CDFW. CESA prohibits the "taking" of listed species except as otherwise provided in State law. Unlike its Federal counterpart, CESA applies the take prohibitions to species petitioned for listing (state candidates). Section 86 of the Fish and Game Code defines "take" as "hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill."

State lead agencies are required to consult with CDFW to ensure that any action it undertakes is not likely to jeopardize the continued existence of any endangered or threatened species or result in destruction or adverse modification of essential habitat. A "lead agency" is defined under the California Environmental Quality Act as the public agency which has principal responsibility for carrying out or approving a project that may have a significant effect on the environment. (PRC §21067)

PORTER-COLOGNE WATER QUALITY CONTROL ACT

The Porter-Cologne Water Quality Control Act (Porter-Cologne) gives the State Water Resources Control Board authority over State water rights and water quality policy. Porter-Cologne also establishes nine Regional Water Quality Control Boards to oversee water quality on a day-to-day basis at the local/regional level. The Regional Boards are responsible for preparing and periodically updating the Basin Plan, which identifies the beneficial uses of water, water quality standards, and actions necessary to control these standards. Regional Boards have the authority to regulate all pollutant discharges from both point and non-point sources that may affect any surface or ground water. The State Board and Regional Boards also act on behalf of the U.S. Environmental Protection Agency to implement and enforce the Clean Water Act in California.

LAKE AND STREAMBED ALTERATION (LSA) AGREEMENT

Section 1600, et. seq., of the California Fish and Game Code contains provisions to protect the State’s watercourses from impairment. Among other things, this statute requires notification of the CDFW prior to undertaking any activity that will substantially divert or obstruct the natural flow of, or substantially change or use any material from, the bed, channel, or bank of, any river, stream, or lake. Through this process, CDFW may require mitigation measures or changes to the project design to eliminate or reduce any harmful impacts to fish and wildlife resources.

NATIVE PLANT PROTECTION ACT (NPPA)

The Native Plant Protection Act (Fish and Game Code § 1900-1913) was enacted in 1977. This Act established the criteria for determining if a species, subspecies, or variety of native plant is endangered or rare. It also has been established that state agencies, in consultation with CDFW, shall implement programs for the conservation of endangered or rare native plants (Fish and Game Code §1911). However, THPs submitted in accordance with the Z’berg-Nejedly Forest Practice Act of 1973 are exempt from this type of regulation (Fish and Game Code §1913). Under this Fish and Game Code Section, where CDFW notifies a landowner that a rare or endangered plant is growing on their land, the landowner shall notify the Department at least 10 days in advance of changing the land use to allow the Department to salvage the plant. Submission of a THP is considered notification of CDFW under this section. Other management activities may not be exempted from Fish and Game Code Section 1911 and 1913

CALIFORNIA FOREST PRACTICE RULES

Forest management activities are subject to the requirements of the Forest Practice Act (FPA) as administered through the Forest Practice Rules (FPR). Registered Professional Foresters (RPFs) follow the provisions of the FPA and FPRs in preparation of timber harvesting plans (THPs). The THP preparation and review process substitutes for the EIR process under CEQA pursuant to PRC section 21080.5. THPs are designed to achieve maximum sustained production of high quality forest products while giving consideration to values relating to recreation, watershed, wildlife, range and forage, fisheries and aesthetic enjoyment as directed by PRC 4651.

The FPRs require timber operations to be designed in a manner that maintains functional wildlife habitat in sufficient condition for continued use by the existing wildlife community within the planning watershed and retains or recruits late and diverse seral stage habitat components for wildlife concentrated in the WLPZs and, as appropriate, to provide for functional connectivity between habitats [14 CCR § 897(b)(1)(B)-(C)]. In addition, the FPRs require RPFs to consider the proposed timber operations in the context of the larger forest and planning watershed in which they are located, so that biological diversity is maintained within larger planning units and adverse cumulative impacts are reduced [14 CCR § 897(b)(2)]. The appendix to Board of Forestry Technical Rule Addendum No. 2 instructs the RPF to consider the factors set forth therein when evaluating cumulative impacts. Factors that the RPF must consider are:

- Any known rare, threatened, or endangered species or sensitive species (as described in the Forest Practice Rules) that may be directly or indirectly affected by project activities;
- Any significant known wildlife or fisheries resource concerns within the immediate project area and the biological assessment area;
- The aquatic and near-water habitat conditions on the THP and immediately surrounding area (pools and riffles, large woody material in the stream, near-water vegetation); and
- The biological habitat condition of the THP and immediately surrounding area (snags/den trees, hardwood cover, downed, large woody debris, late seral (mature) forest characteristics, multistory canopy, late seral habitat continuity, road density and special habitat elements).

Furthermore, the FPRs require the RPF to specifically address wildlife under Article 9 sections 919 through 919.18. In doing so, the RPF must:

- Retain all snags to provide wildlife habitat, except in certain specific cases (near main ridge tops suitable for fire suppression; near public roads, permanent roads, seasonal roads, landings, and railroads; where safety laws and regulations require snags removal; near structures maintained for human habitation;

merchantable snags; and for insect or disease control [14 CCR § 919.1(a)-(e)].

- Provide general protection for sensitive species [per 14 CCR §§ 895.1 and 898.2(d)]. This includes: A mandatory pre-harvest inspection; protection of nest tree(s), designated perch trees(s), screening tree(s), and replacement trees(s) during timber operations; commencement of timber operations as far as possible from occupied nest trees; and protection of the occupied nest tree, screening trees, perch trees, and replacement trees if discovered during timber operations [14 CCR § 919.2(a)-(d)]. Some exceptions to these requirements are allowed.
- Provide specific protection for sensitive species (Bald Eagle, Peregrine Falcon, Golden Eagle, Great Blue Heron, Great Egret, Northern Goshawk, and Osprey). The specific protection measures include buffer zones around all nest trees containing active nests; year-around restrictions within buffer zones; establishment of critical periods for each species with applicable requirements during these critical periods; and limits on helicopter logging during the critical period (14 CCR § 919.4(a)-(e)).
- Incorporate feasible practices to reduce impacts (as described in 14 CCR § 898) where significant adverse impacts to non-listed species are identified (14 CCR § 919.4).
- Ensure that timber operations will not result in “take” of the Northern Spotted Owl and Marbled Murrelet (14 CCR §§ 919, 919.10 and 919.11).
- Provide habitat structure information for late succession forest stands proposed for harvesting where such harvest will significantly reduce the amount and distribution of late succession forest stands or their functional wildlife habitat value so that it constitutes a significant adverse impact on the environment. Also, the RPF must provide a statement of objectives over time for late succession forest stands on the ownership and include a discussion of how the proposed harvesting will affect the existing functional wildlife habitat for species primarily associated with late succession forest stands in the plan or the planning watershed, as appropriate, including impacts on vegetation structure, connectivity, and fragmentation.
- Where timber operations will result in long-term significant adverse effects on fish, wildlife, and listed species known to be primarily associated with late successional forests, feasible mitigation measures to mitigate or avoid such long-term significant adverse effects must be described and incorporated. Where long-term significant adverse effects cannot be avoided or mitigated, the RPF must identify the measures that will be taken to reduce those remaining effects and provide reasons for overriding concerns pursuant to 14 CCR § Section 898.1(g), including a discussion of the alternatives and mitigation considered [14 CCR § 919.16(a)-(b)].

The California Forest Practice Rules also provide protections for wetlands in Coastal Zone Special Treatment Areas, and generally for marshes, wet meadows, springs, riparian areas, and other wet areas.

CALIFORNIA COASTAL ACT

Wetlands found in the "coastal zone" are regulated under the California Coastal Act of 1976 (CCA), and are within jurisdiction of the California Coastal Commission. A Coastal Permit is required for activities within the coastal zone that may have an impact on terrestrial or marine habitat, visual resources, landform alterations, or water quality, among other things. Portions of the assessment area for this Program EIR fall within the coastal zone.

FEDERAL ENDANGERED SPECIES ACT (FESA)

The Federal Endangered Species Act (FESA) requires formal or informal consultation with the US Fish and Wildlife Service or NOAA Fisheries where it is likely that the project could affect federally listed threatened or endangered species. The purpose of the ESA is to conserve the ecosystems upon which listed species depend. The laws ultimate goal is to “recover” listed species such that the protections of the Act are no longer needed. The ESA requires that recovery plans be developed that describe the steps necessary to restore the species. Similarly, the ESA provides for the designation of “critical habitat” when prudent and determinable. Critical habitat includes geographic areas where those physical and biological features essential to the conservation of the species are found and which may require special management considerations or protection. Critical habitat designations affect only Federal agency actions or federally funded or permitted activities. The Act also makes it unlawful to kill or injure a listed species, which includes significant habitat modification or degradation where it actually kills or injures listed species by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering.

MIGRATORY BIRD TREATY ACT

The Migratory Bird Treaty Act makes it illegal for anyone to take, possess, import, export, transport, sell, purchase, barter, or offer for sale, purchase, or barter, any migratory bird, or the parts, nests, or eggs of such a bird except under the terms of a valid permit issued pursuant to Federal regulations. The migratory bird species protected by the Act are listed in 50 CFR 10.13.

CLEAN WATER ACT

Pollutants regulated under the CWA include "priority" pollutants, including various toxic pollutants; "conventional" pollutants, such as biochemical oxygen demand (BOD), total suspended solids (TSS), fecal coliform, oil and grease, and pH; and "non-conventional" pollutants, including any pollutant not identified as either conventional or priority. The CWA regulates both direct and indirect discharges.

Federal protection of wetlands is described in Section 401 of the Clean Water Act. This requires that State water quality standards not be violated by the discharge of fill or dredged material into "Waters of the United States." Section 404 of the Clean Water Act authorizes the US Army Corps of Engineers (ACOE) to issue permits for discharges of dredged or fill material into streams and wetlands.

COASTAL ZONE MANAGEMENT ACT

The Coastal Zone Management Act (CZMA) of 1972 provides for the management of the nation's coastal resources. The CZMA is administered by NOAA with the goal to preserve, protect, develop, and where possible, to restore or enhance the resources of the nation's coastal zone. Portions of the assessment area for this Program EIR fall within the coastal zone.

4.2.1.2 **Biological Setting and Concerns by Bioregion**

Ownership patterns, climate, vegetation and wildlife differ across California. The following analysis is conducted at the bioregional scale, which was determined to be the most appropriate framework to scope the impact of the proposed project on biological resources.

KLAMATH/NORTH COAST

Coastal wetland communities, including estuaries, lagoons, marshes, and open-water bays, are important for shorebirds and provide nursery habitats for anadromous**,** oceanic, and near-shore fish. The coastal wetlands include the estuary at the mouth of the Smith River, Lake Talawa and Lake Earl, Humboldt Bay, the mouth of the Eel River, and Bodega and Tomales bays.

The fish fauna of the Klamath River System (below Copco Lake and Iron Gate reservoir) is dominated by anadromous fish species such as Pacific lamprey, Chinook and coho salmon, and steelhead. Predominately freshwater species are also abundant in the system and include a variety of introduced species and two natives, the speckled dace and Klamath smallscale sucker. Coastal streams, flowing directly to the ocean, support a fish fauna composed predominately of anadromous species including coastal cutthroat Trout and euryhaline freshwater and marine species. The Klamath and Trinity Rivers collectively support the second largest Chinook salmon populations in California. The region is known for these extensive river systems and the anadromous fish populations they support. The majority of California's river segments with state or federal Wild and Scenic river designations occur in the North Coast–Klamath Region, including portions of the Klamath, Trinity, Smith, Scott, Salmon, Van Duzen, and Eel. Anadromous fish species include coho and chinook salmon, steelhead, coast cutthroat trout, green sturgeon, and Pacific lamprey. The region has seen sharp declines in its fish populations, with an 80 percent decline in salmon and steelhead between the 1950s and 1990s (California State Lands Commission, 1993). Nonetheless, the remaining fish populations still represent the most important anadromous fish runs in the state. The region's rivers support one-third of the state's chinook, most of the state's coho salmon and steelhead, and all of the coast cutthroat trout (California State Lands Commission, 1993).

The region's coastal redwoods are among the largest, tallest, and oldest trees in the world, often exceeding 200 feet in height, 15 feet in diameter, and 2,000 years in age. Redwood groves are patchily distributed across the coastal fog belt that extends up to 40 miles inland and where winter rains and summer fog provide a persistent moist environment. Some inhabitants of coastal redwood forests include Spotted Owl, fisher, Humboldt Marten, black bear, Roosevelt elk, MacGillivray's warbler, olive-sided flycatcher, marbled murrelet, Pacific giant salamander, rough-skinned newt, and the banana slug.

Grasslands, coastal shrub, pine forests, mixed evergreen forests, and redwood forests are typical terrestrial plant communities. Unique, geographically limited habitats include sphagnum bogs and pygmy scrub forests.

The region's inland Klamath-Siskiyou mountain ranges are recognized for their biological diversity and have been designated as an area of global botanical significance by the International Union for Conservation of Nature (IUCN), as one of 200 global conservation priority sites by the World Wildlife Fund, and as a proposed United Nations' BIOSphere reserve (Ricketts et al., 1999). These mountains harbor some of the most floristically diverse temperate coniferous forests in the world, attributable in part to the region's variable climate, geography, and soil types, which create a variety of ecological communities. Unique, localized conditions have given rise to endemic species that have evolved to specialize in these areas, including nearly 100 plant species that are restricted to serpentine soils. Additionally, portions of the region remained un-glaciated during the last ice ages and have served as centers of distribution for numerous species that sought refuge there. Finally, these mountains represent the intersection of coastal ecosystems with the inland Klamath Basin region. As a result, the inland mountains and river systems support a rich flora and fauna that include species from both regions. The Klamath river system, for instance, harbors both coastal fish, like salmonids and Coast Range sculpin, and fish whose ranges extend from the inland Klamath Basin, such as the tui chub.

Ecological communities of the inland mountain ranges include moist inland forests dominated by Douglas fir, ponderosa pine, and sugar pine mixed with a variety of other conifers and hardwoods; drier oak forests and savannas; serpentine soil–associated plant communities and shrublands and high elevation subalpine forests. More than 3,000 plant species are known from these inland mountain ranges, and the area supports some 30 temperate conifer tree species, more than any other ecosystem in the world. Wildlife inhabitants include such sensitive species as the northern spotted owl, northern goshawk, Humboldt marten, and Pacific fisher, as well as common species like mule deer, black bear, and red-tailed hawk.

The upper Klamath River System includes Upper and Lower Klamath Lakes and Tule Lake. The fish fauna is dominated by freshwater species including the Klamath Lake sculpin, shortnose sucker, and the Lost River sucker. Stream and lake dwelling species include the dwarf Pacific lamprey, rainbow trout, Klamath largescale sucker, blue chub, Klamath tui chub, speckled dace, and marbled sculpin. Introduced species numbers appear to be increasing in number in the reservoirs of the river system (Moyle, 1976).

The North Coast and Klamath's wide range of habitats has given rise to remarkable biological diversity. There are 501 vertebrate species that inhabit the area at some point in their life cycle, including 282 birds, 104 mammals, 26 reptiles, 30 amphibians, and 59 fish. Of the total vertebrate species that inhabit this region, 76 bird taxa, 26 mammalian taxa, two reptilian taxa, 13 amphibian taxa, and 42 fish taxa are included on the Special Animal List. Of these, 13 are endemic to the region, and nine other species found here are endemic to California but not restricted to this area.

Table 4.2-1 identifies ownership patterns by habitat type within the Klamath/North Coast Bioregion. As discussed in Section 2.5, the scale of the proposed program is limited by several constraints. Table 4.2-2 identifies the number of acres available for treatment in that bioregion by dominant vegetation type (tree, shrub and grass) and treatment alternative (wildland urban interface (WUI), fuel break, and ecological restoration). These figures were reported earlier in Tables 2.5.1 through 2.5.4. Comparison of the two tables below indicates that approximately 42 percent of the total landscape within the Klamath/North Coast Bioregion is available for treatment. Of those acres available, the proposed project anticipates treating approximately 14,699 acres per year (Table 2.5-6), which represents 0.1 percent of the total area of this bioregion.

Table 4.2-1 Habitat Type and Land Ownership Klamath/North Coast Bioregion (CPAD, 2014).

Habitat Type	Bureau of Land Management	United States Forest Service	National Park Service	Other Public	Private	Total
Agriculture	151	346	97	7,718	283,556	291,867
Barren/Other	4,917	65,579	472	5,135	45,464	121,566
Conifer	232,822	4,216,190	78,861	241,587	3,150,837	7,920,296
Hardwood	102,099	615,769	26,973	49,368	1,534,917	2,329,125
Herbaceous	72,790	60,927	4,227	22,099	1,520,917	1,680,960
Shrub	226,479	743,299	5,768	32,923	704,052	1,712,521
Urban	373	2,215	185	5,382	115,252	123,407
Water	1,365	59,031	3,712	16,515	74,162	154,785
Wetland	95	5,382	1	9,094	27,647	42,218
By Habitat Type	**641,090**	**5,768,738**	**120,295**	**389,820**	**7,456,804**	**14,376,746**

Table 4.2-2 Treatable Acres by Dominant Vegetation Type and Treatment Alternative within the Klamath/North Coast Bioregion

Dominate Vegetation Type	WUI	Fuel Breaks	Ecological Restoration	Total by Dominate Vegetation Type
Tree-Dominated	1,545,973	608,831	2,558,494	**4,713,298**
Shrub-Dominated	245,433	93,706	52,087	**391,226**
Grass-Dominated	481,700	165,573	343,164	**990,437**
Total by Treatment	**2,273,106**	**868,110**	**2,953,745**	**6,094,961**

CENTRAL COAST

The Central Coast's wide range of habitats has given rise to remarkable biological diversity. There are 482 vertebrate species that inhabit the Central Coast region at some point in their life cycle, including 283 birds, 87 mammals, 42 reptiles, 25 amphibians, and 45 fish. Of the total vertebrate species that inhabit this region, 80 bird taxa, 36 mammalian taxa, 14 reptilian taxa, eight amphibian taxa, and 15 fish taxa are included on the Special Animals List. Of these, 13 are endemic to the Central Coast region, one is endemic to California but restricted to this region, and 24 other species found here are endemic to California but not restricted to this region.

Sand dunes and wetlands occur along the coast. River-mouth estuaries, lagoons, sloughs, tidal mudflats, and marshes make up coastal wetland communities, a unique environment where marine, freshwater, and terrestrial systems meet. Elkhorn Slough and Morro Bay are the region's two largest estuaries, with other significant wetlands found at the Pajaro, Salinas, and Santa Maria river mouths, Devereux Slough, and Goleta Slough (Page and Shuford, 2000).

Other coastal habitats include coastal scrub and maritime chaparral. Coastal scrub and grasslands also extend inland along river valleys, like the lower Salinas Valley, where the moist maritime climate reaches through gaps in the coastal ranges. Maritime chaparral, characterized by manzanita and California lilac species adapted to the foggy coastal climate, once dominated sandy hills along Monterey Bay, Nipomo Mesa, Burton Mesa, and Morro Bay. Maritime chaparral is now one of the region's most threatened community types, with its extent severely reduced by development.

The outer Coast Ranges, including the Santa Cruz and Santa Lucia mountains, run parallel to the coastline. Well-watered by the moist ocean air, these slopes are drained by streams that run all year. The Santa Lucia Mountains provide most of the water supply to the Salinas River. These ranges support mixed coniferous forests and oak woodlands. The dominant coniferous species include ponderosa pine, Douglas fir, red alder, and, in the north, redwoods. The oak woodlands are dominated by coast live oak and valley oak. Rarer, endemic tree species include Monterey pine and Santa Lucia fir.

Moving inland across the Gabilan, Diablo, Temblor, and Sierra Nevada Madre mountain ranges, the climate becomes progressively drier, and the vegetation shifts to oak woodlands, grasslands, interior chaparral, and desert-like interior scrub. Interior streams are mostly intermittent, drying in the summer and fall, except at the higher elevations of the Sierra Nevada Madre ranges, where streams run year round. Biologically diverse oak woodland communities support more than 200 species of plants, 300 vertebrates, and 5,000 invertebrates (Thorne et al, 2002; TNC, 1997). Large expanses of annual grasslands are dominated by non-native grasses are inhabited by California ground squirrel and black-tailed jackrabbit, along with sensitive species that include the giant kangaroo rat, burrowing owl, San Joaquin kit fox, American badger, and, in the southern portion of the region, reintroduced tule elk and pronghorn. Interior chaparral habitats support drought-resistant woody shrubs, including manzanita, California lilac, and chamise.

The Central Coast's largest drainages include the Salinas, Santa Maria, Pajaro, and Santa Ynez watersheds. Riverine and riparian habitats are important to amphibian and reptile species like the California red-legged frog, foothill yellow-legged frog, and Western pond turtle, and birds like the bank swallow, the Lawrence's goldfinch (on Fish and Game's Special Animals List), and the least Bell's vireo (federally listed as endangered). Steelhead and coho salmon (both federally listed as threatened) are still present, in small numbers, in most of the streams where they historically occurred.

Mammals that use riparian habitats include gray fox, striped skunk, mole and shrew species, and ringtail.

Higher-elevation riparian vegetation in moist coastal climates includes willow, alder, bay, maple, Douglas fir, and sometimes redwood, while valley-bottom riparian communities are dominated by sycamore, willow, alder, and cottonwood. Steep coastal streams in the forested Santa Cruz and northern Santa Lucia mountains are some of the region's most intact systems and host relatively healthy anadromous fish populations (CDFW, 1996). In contrast, the majority of the region's large river-valley floodplain and riparian forests have been replaced by agriculture, and lowland fish assemblages have been severely compromised.

Seasonal vernal-pool wetland complexes are found in many parts of the region, including the Salinas River drainage and coastal dune terraces and mesas of Santa Barbara County, and seasonal sag ponds are found along the San Andreas fault zone, particularly in the eastern portion of San Luis Obispo County.

The San Andreas Fault runs the length of the region and shapes much of the region's geography. Most of the north-south running mountain ranges and valley depressions have been formed as a result of pressure between the two continental plates meeting at this fault zone. Compression, chemical interaction, and surfacing of ancient seabed sediments have produced serpentine soils that are rich in such metals as chromium, nickel, and cobalt, but poor in nutrients. A number of plants have adapted to these harsh, near-toxic conditions, resulting in unique, island-like ecological communities largely restricted to serpentine areas (CBD, 2004; TNC, 1997).

Table 4.2-3 identifies ownership patterns by habitat type within the Central Coast Bioregion. As discussed in Section 2.5, the scale of the proposed program is limited by several constraints. Table 4.2-4 identifies the number of acres available for treatment by dominant vegetation type (tree, shrub and grass) and treatment alternative (wildland urban interface (WUI), fuel break, and ecological restoration). These figures were reported earlier in Tables 2.5-1 through 2.5-4. Comparison of the two tables below indicates that approximately 18 percent of the total landscape within the Central Coast Bioregion is available for treatment. Of those acres available, the proposed project anticipates treating approximately 7,782 acres per year (Table 2.5.6), which represents less than 1 percent of the total area of this bioregion.

Table 4.2-3 Habitat Type and Land Ownership Central Coast Bioregion (CPAD, 2014).

Habitat Type	Bureau of Land Management	United States Forest Service	National Park Service	Other Public	Private	Total
Agriculture	329	360	0	4,015	612,723	617,427
Barren/Other	931	17,416	0	6,690	20,248	45,285
Conifer	2,969	290,834	5	12,207	53,899	359,915
Hardwood	762	79,620	52	5,235	68,242	153,911
Herbaceous	341,439	206,150	18,799	274,320	6,007,741	6,848,449
Shrub	84,156	1,124,863	14,195	80,172	982,964	2,286,350
Urban	1,310	588	10	12,681	241,302	255,891
Water	34	413	7	27,982	15,431	43,868
Wetland	0	0	0	2,217	1,456	3,673
By Habitat Type	**431,932**	**1,720,246**	**33,068**	**425,519**	**8,004,005**	**10,614,770**

Table 4.2-4 Treatable Acres by Dominant Vegetation Type and Treatment Alternative within the Central Coast Bioregion

Dominate Vegetation Type	WUI	Fuel Breaks	Ecological Restoration	Total by Dominate Vegetation Type
Tree-Dominated	52,272	11,457	54,482	**118,211**
Shrub-Dominated	318,622	108,344	287,789	**714,755**
Grass-Dominated	697,260	192,632	215,505	**1,105,397**
Total by Treatment	**1,068,154**	**312,434**	**557,776**	**1,938,363**

SOUTH COAST

The region's largest river drainages include the Tijuana, San Diego, San Luis Rey, Santa Margarita, Santa Ana, San Gabriel, Los Angeles, Santa Clara, and Ventura rivers. Pine forests occur along high-elevation stream reaches, and mountain drainages host mountain yellow-legged frog, California red-legged frog, Santa Ana sucker, and Santa Ana speckled dace. Lower-elevation river reaches support riparian vegetation species, including cottonwood, willow, sycamore, and coast live oak, which provide habitat for such riparian bird species as the least Bell's vireo, southwestern willow flycatcher, Swainson's thrush, and yellow warbler, as well as the arroyo toad.

River flow in this bioregion is closely tied to rainfall. In addition, rivers are more intensively channelized and managed by dams than those in other regions of California. Remnant steelhead runs can be found in the Ventura and Santa Clara Rivers. Other native fish species such as the arroyo chub and Santa Ana sucker have exhibited significant declines in number and available habitat (Trust for Public Lands, 2001).

The region is distinguished by the tremendous population growth and urbanization that have transformed the landscape since the 1940s. This intersection of biological resources and urbanization has made the South Coast the most-threatened biologically diverse area in the continental U.S. (USGS, 2003). More than 150 species of vertebrate animals and 200 species of plants are either listed as protected or considered sensitive by wildlife agencies and conservation groups (Hunter, 1999).

The South Coast's widely variable geography and diverse climate have given rise to remarkable biological diversity. There are 476 vertebrate species that inhabit the South Coast Region at some point in their life cycle, including 287 birds, 87 mammals, 52 reptiles, 16 amphibians, and 34 fish. Of the total vertebrate species that inhabit this region, 82 bird taxa, 40 mammalian taxa, 19 reptilian taxa, eight amphibian taxa, and nine fish taxa are included on the Special Animals List. Of these, 14 are endemic to the South Coast Region, and 14 other species found here are endemic to California but not restricted to this region.

Table 4.2-5 identifies ownership patterns by habitat type within the South Coast Bioregion. As discussed in Section 2.5, the scale of the proposed program is limited by several constraints. Table 4.2-6 identifies the number of acres available for treatment by dominant vegetation type (tree, shrub and grass) and treatment alternative (wildland urban interface (WUI), fuel break, and ecological restoration). These figures were reported earlier in Tables 2.5-1 through 2.5-4. Comparison of the two tables below indicates that approximately 29 percent of the total landscape within the South Coast Bioregion is available for treatment. Of those acres available, the proposed project anticipates treating approximately 4,983 acres per year (Table 2.5-6), which represents less than 1 percent of the total area of this bioregion.

Table 4.2-5 Habitat Type and Land Ownership South Coast Bioregion (CPAD, 2014).

Habitat Type	Bureau of Land Management	United States Forest Service	National Park Service	Other Public	Private	Total
Agriculture	536	282	47	25,121	467,881	493,868
Barren/Other	275	10,070	225	5,647	26,812	43,028
Conifer	7,181	372,825	0	30,328	82,303	492,637
Hardwood	596	119,710	505	24,683	66,957	212,452
Herbaceous	3,888	36,597	3,025	113,738	491,698	648,946
Shrub	137,350	1,179,893	19,123	374,206	1,338,593	3,049,166
Urban	406	6,836	560	101,141	1,928,233	2,037,176
Water	131	3,858	11	33,334	22,360	59,694
Wetland	0	211	0	6,384	6,950	13,545
By Habitat Type	**150,364**	**1,730,281**	**23,496**	**714,582**	**4,431,787**	**7,050,511**

Table 4.2-6 Treatable Acres by Dominant Vegetation Type and Treatment Alternative within the South Coast Bioregion

Dominate Vegetation Type	WUI	Fuel Breaks	Ecological Restoration	Total by Dominate Vegetation Type
Tree-Dominated	111,117	35,727	32,844	**179,687**
Shrub-Dominated	958,274	294,694	247,734	**1,500,702**
Grass-Dominated	280,605	74,630	30,519	**385,754**
Total by Treatment	**1,349,996**	**405,051**	**311,096**	**2,066,144**

SACRAMENTO VALLEY, SAN JOAQUIN VALLEY AND BAY DELTA

The Sacramento Valley, San Joaquin Valley and Bay-Delta Region comprise most of the low-lying lands of Central California. Much of the region is part of a vast hydrological system that drains 40 percent of the state's water. This water, falling as either rain or snow over much of the northern and central parts of the state, drains along the Sacramento and San Joaquin rivers into the Delta. In the Delta, freshwater from these rivers mixes with saltwater from San Francisco Bay, creating a rich and diverse aquatic ecosystem. Encompassing 1,600 square miles of waterways, the San Francisco Bay and Delta together form the West Coast's largest estuary and the second-largest estuary in the nation. The Sacramento Valley, San Joaquin Valley and Bay-Delta Region also supports the colorful waterfowl of the Pacific Flyway that funnel through the area during their annual migrations.

The region has four distinct subregions: the San Francisco Bay Area, the Delta, the Sacramento Valley, and the San Joaquin Valley. Each has unique combinations of climate, topography, ecology, and land-use patterns.

The San Francisco Bay Area subregion, the most densely populated area of the state outside of the Southern California metropolitan region, consists of the low-lying bay lands, aquatic environments, and watersheds that drain into San Francisco Bay. It is bounded on the east by the Delta subregion, on the north by the North Coast Region, on the south by the Central Coast Region, and on the west by the Pacific Ocean. Low coastal mountains surround San Francisco Bay, with several peaks rising above 3,000 feet. The region receives 90 percent of its surface water from the major Central Valley rivers via the Delta. Other major rivers draining into the Bay include the Napa and Petaluma rivers and Sonoma, Petaluma, and Coyote creeks. The Bay Area has relatively cool, often foggy summers and cool winters, strongly influenced by marine air masses. Rain falls almost exclusively during the winter (October to April) and averages 15–25 inches annually, with occasional snowfall at higher elevations. Rainwater runs off rapidly, and most of the smaller streams are dry by the end of the summer.

The topography allows for a variety of different habitats. The Bay itself has both deep and shallow estuarine (mixed freshwater and saltwater) environments. In addition to estuarine species, the Bay also supports many marine species, including invertebrates, sharks, and even, on occasion, whales. Along the shoreline are coastal salt marsh, coastal scrub, tidal mudflats, and salt ponds. Freshwater creeks and marshes, especially those that still have patches of riparian vegetation, are home to aquatic invertebrates and freshwater fish such as Delta smelt and sturgeon. Upland areas support a mixture of grasslands, chamise chaparral, and live oak and blue oak woodlands. Small stands of redwood, Douglas fir, and tanoak grow in moister areas.

The Great Central Valley of California contains the other three subregions: the Sacramento Valley, the San Joaquin Valley, and the Sacramento–San Joaquin Delta. Together, they form a vast, flat valley, approximately 450 miles long and averaging 50 miles wide, with elevations almost entirely below 300 feet. The Sutter Buttes, a circular set of 2,000-foot-high hills which rise from the middle of the valley floor (promoted locally as the “Smallest Mountain Range in the World”), is the only topographic feature that exceeds that height. The Central Valley is surrounded by the Sierra Nevada on the east, the coastal ranges on the west, the Tehachapi Mountains on the south, and the Klamath and Cascade mountains on the north. Less influenced by marine air than San Francisco Bay, the valley’s climate has hot, dry summers and foggy, rainy winters. Annual rainfall averages from 5 inches to 25 inches, with the least rainfall occurring in the southern portions and along the west side (in the rain shadow of the coastal mountains). Agriculture dominates land uses in the Central Valley, with very few remnants of natural land remaining.

The major natural upland habitats are annual grassland, valley oaks on floodplains, and vernal pools on raised terraces. The more arid lands of the southern San Joaquin Valley also contain alkali sink and saltbush shrublands. Slow-moving rivers along the valley floor provide habitat for fish and invertebrates and help maintain adjacent riparian, wetland, and floodplain habitats.

Hydrology is the main difference between the three Central Valley subregions. The Delta is a low-lying area that contains the tidally influenced portions of the Sacramento, San Joaquin, Mokelumne, and Consumnes rivers. The Delta was once a huge marsh formed by the confluence of the Sacramento and San Joaquin rivers. Once described as a "terraqueous labyrinth of such intricacy that unskillful navigators have been lost for days in it" (Bryant 1848), it has been extensively drained and diked for flood protection and agriculture. Exposure of the rich, organic soils behind these levees has increased oxidation rates to such an extent that the land is breaking down and much of the surface has now subsided below sea level. Due to its natural patterns of flooding, the Delta is relatively less populated than the other subregions. The second subregion, the Sacramento Valley, contains the Sacramento River, the largest river in the state. This river historically overflowed into several low-lying areas, particularly in its lower reaches.

The lower 180 miles of the river, below Chico Landing, are now constrained by levees, and excess floodwaters are diverted into large bypasses to reduce risks to people.

The third subregion of the Central Valley, the San Joaquin Valley, has two distinct, or separate, drainages. In the northern portion, the San Joaquin River flows north toward the Delta. It captures water via several major rivers that drain the central Sierra Nevada. The southern portion of the valley is isolated from the ocean and drains into the closed Tulare Basin, which includes the beds of the former Tulare, Buena Vista, and Kern lakes. These lakes and vast wetlands historically were fed by the rivers that drain the southern Sierra Nevada (the Kings, Kaweah, Tule, and Kern). These lakes are now dry most of the time because water has been diverted to upland agriculture. Runoff during the wettest years will occasionally flood out of river channels and temporarily refill some of these lakebeds. The California Aqueduct extends along the entire western edge of the valley, delivering water from the Delta to farmers in the Tulare basin and over the Tehachapi Mountains to Southern California. The wildlife of this region is beset by a wide variety of stressors, described below. The major problem has been the loss, degradation, and fragmentation of habitats, both terrestrial and aquatic, due to the development of agriculture and urban areas. Many of the streams have been dammed, blocking fish migration, or have been so severely degraded that they are no longer usable by salmon. Flood control structures, such as dikes, levees, and hardened embankments (riprap), have altered floodplain habitats like riparian forests and wetlands throughout the region. Many other species that persist on the remaining habitat fragments are at risk of local or range wide extinction. Ninety-five percent of the historic Central Valley salmon habitat has been lost (CDFW, 1993).

This region is primarily in private ownership, and the role of private landowners is very important for conservation. More than 75 percent of the known California locations of 32 animal species of concern occur predominately on private lands. Examples of these species include Swainson's hawk, burrowing owl, San Pablo vole, and Buena Vista Lake shrew.

Improvement in the status and sustainability of this bioregions' four runs of Chinook salmon is an important resource management goal. Reservoir dams block access to historically available Chinook salmon and steelhead spawning and rearing habitat. The current extent of spawning habitat available for salmonids (approximately 300 miles) is 5 percent of that available historically (Trust for Public Lands, 2001). Dams have also interrupted the recruitment of coarse sediment and organic material to downstream reaches. Central Valley reservoirs support sport fisheries composed primarily of non-native species or hatchery supplemented fish populations.

There are 490 vertebrate species that inhabit the Central Valley and Bay-Delta Region at some point in their life cycle, including 279 birds, 88 mammals, 40 reptiles, 18 amphibians, and 65 fish. Of the total vertebrate species that inhabit this region, 80 bird taxa, 38 mammalian taxa, 11 reptilian taxa, six amphibian taxa, and 25 fish taxa are included on the California Department of Fish and Game's Special Animals List. Of these, 20 are endemic to the Central Valley and Bay-Delta Region, and 28 other species found here are endemic to California but not restricted to this region.

Table 4.2-7 identifies ownership patterns by habitat type within the San Joaquin Bioregion. As discussed in Section 2.5, the scale of the proposed program is limited by several constraints. Table 4.2-8 identifies the number of acres available for treatment by dominant vegetation type (tree, shrub and grass) and treatment alternative (wildland urban interface (WUI), fuel break, and ecological restoration). These figures were reported earlier in Tables 2.5-1 through 2.5-4. Comparison of the two tables below indicates that approximately 9 percent of the total landscape within the San Joaquin Bioregion is available for treatment. Of those acres available, the proposed project anticipates treating approximately 4,860 acres per year (Table 2.5-6), which represents less than 0.1 percent of the total area of this bioregion.

Table 4.2-7 Habitat Type and Land Ownership San Joaquin Bioregion (CPAD, 2014)

Habitat Type	Bureau of Land Management	United States Forest Service	National Park Service	Other Public	Private	Total
Agriculture	6,693	0	0	30,080	4,937,082	4,973,854
Barren/Other	121	526	0	237	2,156	3,040
Conifer	5,986	57,273	0	11,807	10,758	85,825
Hardwood	28	1,863	0	3,741	23,814	29,446
Herbaceous	239,681	3,605	0	234,769	1,862,981	2,341,036
Shrub	67,600	9,269	0	15,948	162,739	255,556
Urban	2,858	119	0	9,241	408,431	420,649
Water	3,547	0	0	11,611	27,006	42,163
Wetland	34	0	0	19,534	53,256	72,824
By Habitat Type	**326,547**	**72,656**	**0**	**336,967**	**7,488,223**	**8,224,394**

Table 4.2-8 Treatable Acres by Dominant Vegetation Type and Treatment Alternative within the San Joaquin Bioregion

Dominate Vegetation Type	WUI	Fuel Breaks	Ecological Restoration	Total by Dominate Vegetation Type
Tree-Dominated	9,439	5,105	14,101	**28,645**
Shrub-Dominated	27,145	20,580	26,306	**74,032**
Grass-Dominated	308,839	265,978	69,695	**644,512**
Total by Treatment	**345,424**	**291,663**	**110,102**	**747,189**

Table 4.2-9 identifies ownership patterns by habitat type within the Bay Delta Bioregion. As discussed in Section 2.5, the scale of the proposed program is limited by several constraints. Table 4.2-10 identifies the number of acres available for treatment by dominant vegetation type (tree, shrub and grass) and treatment alternative (wildland urban interface (WUI), fuel break, and ecological restoration). These figures were reported earlier in Tables 2.5-1 through 2.5-4. Comparison of the two tables below indicates that approximately 40 percent of the total landscape within the Bay Delta Bioregion is available for treatment. Of those acres available, the proposed project anticipates treating approximately 5,760 acres per year (Table 2.5-6), which represents 0.1 percent of the total area of this bioregion.

Table 4.2-9 Habitat Type and Land Ownership Bay Delta Valley Bioregion (CPAD, 2014)

Habitat Type	Bureau of Land Management	United States Forest Service	National Park Service	Other Public	Private	Total
Agriculture	915	0	4,093	60,145	1,353,552	1,418,706
Barren/Other	62	0	1,238	2,171	7,638	11,108
Conifer	7,429	0	18,815	164,712	316,800	507,757
Hardwood	3,352	0	1,903	76,869	405,137	487,260
Herbaceous	5,217	0	30,731	359,093	1,323,469	1,718,510
Shrub	30,374	0	26,038	186,815	369,847	613,074
Urban	62	0	2,953	89,495	932,228	1,024,737
Water	125	0	946	60,208	36,760	98,038
Wetland	549	0	1,071	31,948	77,203	110,771
By Habitat Type	**48,086**	**0**	**87,788**	**1,031,454**	**4,822,633**	**5,989,962**

Table 4.2-10 Treatable Acres by Dominant Vegetation Type and Treatment Alternative within the Bay Delta Bioregion

Dominate Vegetation Type	WUI	Fuel Breaks	Ecological Restoration	Total by Dominate Vegetation Type
Tree-Dominated	588,675	108,736	247,734	**945,144**
Shrub-Dominated	192,543	56,220	88,840	**337,603**
Grass-Dominated	697,260	192,632	215,505	**1,105,397**
Total by Treatment	**1,478,478**	**357,587**	**552,079**	**2,388,144**

Table 4.2-11 identifies ownership patterns by habitat type within the Sacramento Valley Bioregion. As discussed in Section 2.5, the scale of the proposed program is limited by several constraints. Table 4.2-12 identifies the number of acres available for treatment by dominant vegetation type (tree, shrub and grass) and treatment alternative (wildland urban interface (WUI), fuel break, and ecological restoration). These figures were reported earlier in Tables 2.5-1 through 2.5-4. Comparison of the two tables below indicates that approximately 23 percent of the total landscape within the Sacramento Valley Bioregion is available for treatment. Of those acres available, the proposed project anticipates treating approximately 2,186 acres per year (Table 2.5-6), which represents less than 1 percent of the total area of this bioregion.

Table 4.2-11 Habitat Type and Land Ownership Sacramento Valley Bioregion (CPAD, 2014)

Habitat Type	Bureau of Land Management	United States Forest Service	National Park Service	Other Public	Private	Total
Agriculture	334	12	0	37,042	1,797,895	1,835,283
Barren/Other	289	10	0	1,910	16,337	18,547
Conifer	19	4	0	295	3,370	3,688
Hardwood	854	22	0	14,652	62,155	77,683
Herbaceous	36,716	394	0	184,529	1,310,670	1,532,309
Shrub	6,063	0	0	1,661	24,960	32,684
Urban	209	22	0	14,492	306,373	321,096
Water	549	10	0	19,144	32,968	52,671
Wetland	386	22	0	28,470	49,928	78,807
By Habitat Type	**45,420**	**497**	**0**	**302,197**	**3,604,657**	**3,952,770**

Table 4.2-12 Treatable Acres by Dominant Vegetation Type and Treatment Alternative within the Sacramento Bioregion

Dominate Vegetation Type	WUI	Fuel Breaks	Ecological Restoration	Total by Dominate Vegetation Type
Tree-Dominated	25,443	10,156	8,018	**43,617**
Shrub-Dominated	3,583	2,304	718	**6,605**
Grass-Dominated	492,285	188,351	175,351	**855,987**
Total by Treatment	**521,311**	**200,810**	**184,088**	**906,209**

MODOC

The Modoc Plateau Region is located in the northeastern corner of the state, framed by and including the Warner Mountains and Surprise Valley along the Nevada border to the east and extending west to the edge of the southern Cascades Range. The region extends north to the Oregon border and south to include the Skedaddle Mountains and the Honey Lake Basin.

A million years ago, layered lava flows formed the 4,000-5,000 foot elevation Modoc Plateau, separating the watersheds of the region from the Klamath drainage to the northwest. The waters of the western slope of the Warner Mountains and the Modoc Plateau carved a new course, the Pit River, flowing to the southwest through the Cascades and joining the Sacramento River.

Situated on the western edge of the Great Basin, the Modoc Plateau historically has supported high desert plant communities and ecosystems similar to that region-shrub-steppe, perennial grasslands, sagebrush, antelope bitterbrush, mountain mahogany, and juniper woodlands. Sagebrush plant communities are characteristic of the region, providing important habitat for sagebrush-dependent wildlife. Conifer forests dominate the higher elevations of the Warner Mountains and the smaller volcanic mountain ranges and hills that shape the region. Wetland, spring, meadow, vernal pool, riparian, and aspen communities scattered across the rugged and otherwise dry desert landscape support diverse wildlife. The region has varied aquatic habitats, from high mountain streams to the alkaline waters of Goose Lake and Eagle Lake to clear spring waters of Fall River and Ash Creek.

Northeastern California is an outstanding region for wildlife, providing habitat for mountain lion, mule deer, pronghorn, Rocky Mountain elk, greater sage-grouse, and the colorful waterfowl of the Pacific Flyway that funnel through the area during their annual migrations.

Golden eagles, peregrine and prairie falcons, northern goshawks, sandhill cranes, and American white pelicans nest and hunt or forage in the region. The varied aquatic habitats and natural barriers along the Pit River and its tributaries have allowed the evolution of several unique aquatic communities that include endemic fish and invertebrates.

Sixty percent of the region is federally managed; the Forest Service manages 30 percent, BLM manages 26 percent, and the Fish and Wildlife Service and the Department of Defense each manage about 2 percent of the lands. State Fish and Game manages 1 percent of the region as wildlife areas. About 37 percent of the lands are privately owned or belong to municipalities.

Only 9 percent of the forests and rangelands of the Modoc region are designated as reserves, such as wilderness areas, less than is protected in other regions of the state except the Central Valley. The wilderness areas and refuges in the region are grazed by livestock (CAL FIRE, 2003). The combined total of lands managed by State Parks and the National Park Service is about 2,500 acres.

There are 399 vertebrate species that inhabit the Modoc Plateau region at some point in their life cycle, including 235 birds, 97 mammals, 23 reptiles, six amphibians, and 38 fish. Of the total vertebrate species that inhabit this region, 57 bird taxa, 21 mammalian taxa, three reptilian taxa, one amphibian taxon, and 20 fish taxa are included on the Special Animals List. Of these, three are endemic to the Modoc Plateau region, one is endemic to California but introduced to this region, and three species found here are endemic to California but not restricted to this region.

Many of the region's plant communities and ecosystems have been substantially altered or degraded over the last 120 years by a combination of stressors. Despite being in one of the least-developed regions of the state, the sagebrush, perennial bunchgrass, aspen, bitterbrush, and mountain mahogany habitats of the Modoc Plateau are among the most threatened ecosystems of North America (TNC, 2001). Aspen stands are in sharp decline (Di Orio et al., 2005). Many of the meadow and riparian areas are overgrazed or are suffering from encroachment by juniper, pine, fir, and invasive plants (Loft et al., 1998; USFS, 2001; 1991b).

Table 4.2-13 identifies ownership patterns by habitat type within the Modoc Bioregion. As discussed in Section 2.5, the scale of the proposed program is limited by several constraints. Table 4.2-14 identifies the number of acres available for treatment by dominant vegetation type (tree, shrub and grass) and treatment alternative (wildland urban interface (WUI), fuel break, and ecological restoration). These figures were reported earlier in Tables 2.5-1 through 2.5-4. Comparison of the two tables below indicates that approximately 35 percent of the total landscape within the Modoc Bioregion is available for treatment. Of those acres available, the proposed project anticipates treating approximately 6,936 acres per year (Table 2.5-6), which represents approximately 0.8 percent of the total area of this bioregion.

Table 4.2-7 Habitat Type and Land Ownership Modoc Bioregion (CPAD, 2014)

Habitat Type	Bureau of Land Management	United States Forest Service	National Park Service	Other Public	Private	Total
Agriculture	3,230	1,592	46	49,876	430,654	485,397
Barren/Other	35,069	37,304	12,100	1,711	37,164	123,348
Conifer	253,546	1,712,588	87,210	21,351	1,382,115	3,456,811
Hardwood	7,356	39,171	456	4,439	66,859	118,281
Herbaceous	14,898	53,948	61	48,606	297,481	414,995
Shrub	1,075,700	965,456	51,198	83,192	1,021,490	3,197,037
Urban	345	166	60	266	22,725	23,562
Water	8,749	39,291	1,960	53,844	258,880	362,723
Wetland	8,189	20,334	709	14,216	94,709	138,156
By Habitat Type	**1,407,082**	**2,869,849**	**153,801**	**277,501**	**3,612,077**	**8,320,310**

Table 4.2-8 Treatable Acres by Dominant Vegetation Type and Treatment Alternative within the Modoc Bioregion

Dominate Vegetation Type	WUI	Fuel Breaks	Ecological Restoration	Total by Dominate Vegetation Type
Tree-Dominated	414,674	235,654	1,032,694	**1,683,021**
Shrub-Dominated	256,274	162,586	566,836	**985,696**
Grass-Dominated	113,321	42,375	51,341	**207,037**
Total by Treatment	**784,269**	**440,614**	**1,650,871**	**2,875,754**

SIERRA NEVADA

Extending approximately 525 miles from north to south, the Sierra Nevada and Cascade ranges form the spine of the California landscape. The mostly volcanic southern Cascades stretch from north of the Oregon border southeastward, merging just south of Mt. Lassen with the northern reaches of the predominantly granitic Sierra Nevada. To the south, the Sierra Nevada embraces the Mojave Desert to the east and curves south to link with the Tehachapi Mountains. The region includes the oak woodland foothills on the western slopes of the Sierra Nevada and Cascade ranges and, on the east, the Owens Valley and edges of the Great Basin.

On the west side, the slope of the Sierra Nevada and Cascades rises gradually from near sea level at the floor of the Central Valley to ridges ranging from 6,000 feet in the north to 14,000 feet in the south, then dropping off sharply to the east.

Unlike the Sierra Nevada, however, the east side of the Cascades slopes gradually. As the Sierra Nevada elevation increases from west to east, life zones transition from chaparral and oak woodlands to lower-level montane forests of ponderosa and sugar pine to upper montane forests of firs, Jeffrey and lodgepole pine and, above timberline, to alpine plant communities.

Federal agencies manage about 61 percent of the Sierra Nevada and Cascades: 46 percent by the Forest Service, 8 percent by the National Park Service, and 7 percent by the Bureau of Land Management. About 2 million acres are wilderness areas, mostly in the eastern and southern Sierra Nevada, managed by the Forest Service. Lands managed by the National Park Service include Lassen Volcanic, Sequoia, Kings Canyon, and Yosemite national parks and Devils Postpile National Monument. State parks and wildlife areas account for 1 percent of the region, and the remaining, approximately 36 percent of the Sierra Nevada and Cascades, is privately owned. Most of the higher elevations and the eastern Sierra Nevada are public lands, whereas most of the oak woodlands and lower mixed conifer forests and rangelands below 3,000 feet on the western slope are in private ownership. There is a checkerboard ownership pattern of private and public lands in areas of the northern half of the Sierra Nevada that lie near historical railway routes (CNRA, 2004; SNEP, 1996).

About 40 percent of the state's surface-water runoff flows to the Central Valley from the Sierra Nevada and Cascades. These flows are critical to meet California's hydropower demands and agricultural and drinking water needs. Much of the water is stored in reservoirs and is conveyed by aqueducts to irrigate agriculture from Redding to Bakersfield and to provide drinking water for most of urbanized California, including the San Francisco Bay Area and Southern California (DWR, 1998).

Streams of the eastern Sierra make up the Lahontan system. Stream habitat structure and condition are similar across the system which has resulted in a relatively low number of native fish species (8). Introduced brook, rainbow, and brown trout have largely replaced native Lahontan and Paiute cutthroat trout. Paiute sculpin, mountain sucker, mountain whitefish, and speckled dace become an increasingly important part of the fish fauna as stream gradients decrease and the frequency of pool habitats increase.

The hundreds of creeks and streams of the western slope of the Sierra Nevada and Cascades drain via a dozen major river basins to merge with the Sacramento River in the north and the San Joaquin River in the south, eventually joining at the San Francisco Bay Delta. The southern forks of the Kings River and streams further south drain into the Tulare basin. The streams east of the Sierra Nevada crest flow into the Great Basin via the Lahontan, Mono, and Owens drainages. Many of the springs and creeks of northeastern California drain via the Pit River, which winds through the Cascades and joins the Sacramento River at Lake Shasta. Maintaining and restoring the ecological health of these watersheds and aquatic systems is important to ensure clean water.

Bold topography, the large elevation gradient, and varied climatic conditions of the Sierra Nevada and Cascades support diverse plant communities. Fifty percent of California's 7,000 vascular plants are found in the region, and more than 400 plant species are endemic (Shevock, 1996). The varied conditions and floristically and structurally diverse plant communities provide a large array of habitats important for maintaining California's wildlife diversity and abundance.

The altered forest ecosystems of the Sierra Nevada and Cascades largely lack the qualities of old-growth forests or late-seral stage forests (forests that are in the later stages of development with large-diameter trees, snags, and logs) that are important for diverse and abundant wildlife (Franklin and Fites-Kaufman, 1996; USFS, 2001). Species that depend on old-growth or late-seral stage forest habitat, like the Pacific fisher, have been negatively affected. The degradation of mountain meadows and loss of willows and other riparian woody plants have affected the endangered willow flycatcher and other species that have similar habitat requirements.

New conservation challenges and opportunities will affect the Sierra Nevada and Cascade ranges in the next few decades. How new development is managed will determine the extent of wildlife habitat fragmentation. Changing global climate will alter depth and seasonality of snowpack, further modifying river flow regimes and ecosystems. The relicensing of hydropower projects provides an opportunity to change hydropower operations to reduce their effects on fish and wildlife.

Concerned about the decline of old forests and associated wildlife species of the region, Congress funded, in 1993, the Sierra Nevada Ecosystem Project (SNEP), based at U.C. Davis, for the “scientific review of the remaining old growth in the national forests of the Sierra Nevada in California, and for the study of the entire Sierra Nevada ecosystem by an independent panel of scientists, with expertise in diverse areas related to this issue.” The forests of the Sierra Nevada, Cascades, and the Modoc Plateau were evaluated by a multidisciplinary team of scientists from many organizations.

SNEP completed its work and published a three-volume report in 1996. Based on the work of dozens of scientists, the report analyzed the status of conifer forests, rangelands, meadow and riparian plant communities, and aquatic ecosystems, and suggested alternatives to restore ecosystems. SNEP concluded that aquatic and riparian systems are the most altered and impaired habitats of the Sierra Nevada and Cascades. Among other critical findings, SNEP found that key causes of the decline of mammals, birds, and other vertebrates in the Sierra Nevada, Cascades, and Modoc regions include the loss and degradation of riparian areas, foothill woodlands, and diverse old forest habitats (including large trees, snags, fallen logs, and layered vegetative structure).

Meanwhile, a 1992 technical report by the Forest Service’s Pacific Southwest Research Station highlighting at-risk California spotted owl populations triggered challenges and debate. That debate prompted the Forest Service to initiate a multiyear planning process that resulted in the Sierra Nevada Framework for Conservation and Collaboration, which evolved into the Sierra Nevada Forest Plan Amendment Final Environmental Impact Statement (SNFPA) covering the national forests of the Sierra Nevada, Cascades, and Modoc regions. In January 2001, The U.S. Forest Service announced the SNFPA Record of Decision, describing chosen management options. In

January 2004, the SNFPA was amended, reducing livestock-grazing and timber-harvest restrictions and giving the Forest Service greater management discretion.

There are 572 vertebrate species that inhabit the Sierra Nevada and Cascades region at some point in their life cycle, including 293 birds, 135 mammals, 46 reptiles, 37 amphibians, and 61 fish. Of the total vertebrate species that inhabit this region, 83 bird taxa, 41 mammalian taxa, 12 reptilian taxa, 23 amphibian taxa, and 31 fish taxa are included on the Special Animals List. Of these, 26 are endemic to the Sierra Nevada and Cascades Region, two are endemic to California but introduced in this region, and 26 other species found here are endemic to California but not restricted to this region.

Table 4.2-15 identifies ownership patterns by habitat type within the Modoc Bioregion. As discussed in Section 2.5, the scale of the proposed program is limited by several constraints. Table 4.2-16 identifies the number of acres available for treatment by dominant vegetation type (tree, shrub and grass) and treatment alternative (wildland urban interface (WUI), fuel break, and ecological restoration). These figures were reported earlier in Tables 2.5-1 through 2.5-4. Comparison of the two tables below indicates that approximately 28 percent of the total landscape within the Modoc Bioregion is available for treatment. Of those acres available, the proposed project anticipates treating approximately 12,171 acres per year (Table 2.5-6), which represents less than 0.1 percent of the total area of this bioregion.

Table 4.2-9 Habitat Type and Land Ownership Sierra Nevada Bioregion (CPAD, 2014)

Habitat Type	Bureau of Land Management	United States Forest Service	National Park Service	Other Public	Private	Total
Agriculture	8,925	1,211	7	6,605	312,117	328,866
Barren/Other	18,846	781,560	441,328	86,261	31,948	1,359,942
Conifer	182,538	5,077,244	942,537	95,082	1,543,788	7,841,189
Hardwood	68,453	446,941	105,980	46,472	758,582	1,426,428
Herbaceous	126,237	210,380	25,569	93,819	2,663,056	3,119,062
Shrub	759,165	1,828,689	63,199	325,995	616,226	3,593,274
Urban	1,129	6,127	578	8,647	160,485	176,967
Water	7,985	76,903	18,572	124,475	132,259	360,195
Wetland	1,398	47,456	19,691	12,576	14,633	95,753
By Habitat Type	**1,174,675**	**8,476,512**	**1,617,460**	**799,933**	**6,233,095**	**18,301,675**

Table 4.2-10 Treatable Acres by Dominant Vegetation Type and Treatment Alternative within the Sierra Nevada Bioregion

Dominate Vegetation Type	WUI	Fuel Breaks	Ecological Restoration	Total by Dominate Vegetation Type
Tree-Dominated	1,436,767	203,453	878,311	**2,518,532**
Shrub-Dominated	319,545	91,159	91,049	**501,752**
Grass-Dominated	1,230,353	229,006	566,858	**2,026,217**
Total by Treatment	**2,986,664**	**523,617**	**1,536,219**	**5,046,500**

MOJAVE

About 80 percent of the Mojave Desert in California is managed by federal agencies. The Bureau of Land Management (BLM), the largest land manager of the region, oversees 8 million acres, or 41 percent, of the federally owned sector. The National Park Service manages the Mojave National Preserve and Death Valley and Joshua Tree national parks, which account for another 26 percent of the region. The Department of Defense manages five military bases that cover about 13 percent of the region. About 30 percent of the region belongs to private landowners or municipalities (CPAD, 2014).

The Amargosa and Mohave Rivers are found in this bioregion and provide habitat for the desert pupfish and other pupfish species.

There are 439 vertebrate species that inhabit the Mojave Desert Region at some point in their life cycle, including 252 birds, 101 mammals, 57 reptiles, 10 amphibians, and 19 fish. Of the total vertebrate species that inhabit this region, 69 bird taxa, 38 mammalian taxa, 15 reptilian taxa, four amphibian taxa, and nine fish taxa are included on the Special Animals List. Of these, 14 are endemic to the Mojave Desert Region, one is endemic to California but restricted to this region, and 15 other species found here are endemic to California but not restricted to this region.

Table 4.2-17 identifies ownership patterns by habitat type within the Mojave Bioregion. As discussed in Section 2.5, the scale of the proposed program is limited by several constraints. Table 4.2-18 identifies the number of acres available for treatment by dominant vegetation type (tree, shrub and grass) and treatment alternative (wildland urban interface (WUI), fuel break, and ecological restoration). These figures were reported earlier in Tables 2.5-1 through 2.5-4. Comparison of the two tables below indicates that approximately 5 percent of the total landscape within the Mojave

Bioregion is available for treatment. Of those acres available, the proposed project anticipates treating approximately 2,624 acres per year (Table 2.5-6), which represents less than 0.01 percent of the total area of this bioregion.

Table 4.2-11 Habitat Type and Land Ownership Mojave Bioregion (CPAD, 2014).

Habitat Type	Bureau of Land Management	United States Forest Service	National Park Service	Other Public	Private	Total
Agriculture	1,503	14	0	383	184,099	185,999
Barren/Other	56,623	2,254	234,759	10,592	150,487	454,715
Conifer	188,932	31,991	210,392	20,729	162,938	614,981
Hardwood	760	917	25	632	9,027	11,361
Herbaceous	60,883	4,198	0	6,378	107,240	178,699
Shrub	7,810,179	45,124	4,702,663	405,682	5,148,067	18,111,715
Urban	12,982	78	3,201	1,998	322,414	340,673
Water	2,924	164	2,061	3,359	8,869	17,376
Wetland	6,981	47	741	66	11,052	18,887
By Habitat Type	**8,141,766**	**84,787**	**5,153,842**	**449,819**	**6,104,193**	**19,934,407**

Table 4.2-12 Treatable Acres by Dominant Vegetation Type and Treatment Alternative within the Mojave Bioregion

Dominate Vegetation Type	WUI	Fuel Breaks	Ecological Restoration	Total by Dominate Vegetation Type
Tree-Dominated	40,905	26,068	62,050	**129,022**
Shrub-Dominated	194,691	667,615	28,548	**890,853**
Grass-Dominated	31,932	15,910	20,482	**68,324**
Total by Treatment	**267,527**	**709,593**	**111,080**	**1,088,200**

COLORADO DESERT

The region's terrestrial habitats include creosote bush scrub; mixed scrub, including yucca and cholla cactus; desert saltbush; sandy soil grasslands; and desert dunes. Higher elevations are dominated by pinyon pine and California juniper, with areas of manzanita and Coulter pine. In addition to hardy perennials, more than half of the desert's plant species are herbaceous annuals, and appropriately timed winter rains produce abundant early spring wildflowers. In the southern portion of the region, the additional moisture supplied by summer rainfall fosters the germination of summer annual plants and supports smoketree, ironwood, and palo verde trees.

In the Colorado Desert's arid environment, aquatic and wetland habitats are limited in extent but are critically important to wildlife. Runoff from seasonal rains and groundwater springs forms canyon mouth- associated alluvial fans, desert arroyos, desert fan palm oases, freshwater marshes, brine lakes, desert washes, ephemeral and perennial streams, and riparian vegetation communities dominated by cottonwood, willow, and non-native tamarisk. Two of the region's most significant aquatic systems are the Salton Sea and the Colorado River.

While most desert wildlife depends on aquatic habitats as water sources, a number of species, such as arroyo toad, desert pupfish, Yuma clapper rail, and southwestern willow flycatcher, are restricted to these habitats. In some places, summer rains produce short-lived seasonal pools that host uncommon species like Couch's spadefoot toad.

Desert fan palm oases are rare ecological communities found only in the Colorado Desert here permanent water sources are available. With an overstory of desert fan palm trees, these communities provide unique islands of shade, moisture, and vegetation in an otherwise arid and sparse landscape.

BLM administers about 2.9 million acres, or 43.1 percent of the region. Department of Defense lands account for about 500,000 acres, or 7 percent, of the region and are the bioregions largest land manager. Joshua Tree National Park spans the transition from the Mojave to the Colorado Desert, with slightly less than half the park, about 340,000 acres, in the Colorado Desert. Anza Borrego Desert State Park encompasses over 600,000 acres, or nearly 9 percent, of the region, and the Santa Rosa Wildlife Area, which includes Fish and Wildlife, State Lands Commission, and BLM lands, encompasses about 100,000 acres.

Together, Joshua Tree National Park, Anza Borrego Desert State Park, and the Santa Rosa Wildlife Area, along with other protected lands in the Mojave Desert, are part of the Mojave and Colorado Deserts Biosphere Reserve, designated by the United Nations as an important global site for preservation of the biological and cultural resources of these two desert regions.

The diverse wildlife inhabiting the Colorado Desert include many species specially adapted to the unique desert habitats. There are 481 vertebrate species that inhabit the region at some point in their life cycle, including 282 birds, 82 mammals, 66 reptiles, 16 amphibians, and 35 fish. Of these vertebrate species, 84 bird taxa, 34 mammalian taxa, 21 reptilian taxa, five amphibian taxa, and four fish taxa are in included on the Special Animals List. Of these, four are endemic to the Colorado Desert region, and four other species found here are endemic to California but not restricted to this region.

Table 4.2-19 identifies ownership patterns by habitat type within the Colorado Desert Bioregion. As discussed in Section 2.5, the scale of the proposed program is limited by several constraints. Table 4.2-20 identifies the number of acres available for treatment by dominant vegetation type (tree, shrub and grass) and treatment alternative (wildland urban interface (WUI), fuel break, and ecological restoration). These figures were reported earlier in Tables 2.5-1 through 2.5-4. Comparison of the two tables below indicates that approximately 6 percent of the total landscape within the Colorado Desert Bioregion is available for treatment. Of those acres available, the proposed project anticipates treating approximately 1,058 acres per year (Table 2.5-6), which represents less than 0.2 percent of the total area of this bioregion.

Table 4.2-13 Habitat Type and Land Ownership Colorado Desert Bioregion (CPAD, 2014)

Habitat Type	Bureau of Land Management	United States Forest Service	National Park Service	Other Public	Private	Total
Agriculture	16,357	2	0	28,225	775,248	819,833
Barren/Other	90,780	35	165	7,477	1,826	100,284
Conifer	17,501	1,273	1,155	55,811	5,837	81,577
Hardwood	3,594	576	0	1,484	823	6,477
Herbaceous	3,779	20	0	696	59,750	64,245
Shrub	2,767,070	6,972	343,168	777,248	1,355,994	5,250,451
Urban	6,600	36	151	4,428	166,125	177,341
Water	4,594	0	0	203,163	44,032	251,788
Wetland	3	0	0	42	585	630
By Habitat Type	**2,910,277**	**8,914**	**344,640**	**1,078,574**	**2,410,219**	**6,752,625**

Table 4.2-14 Treatable Acres by Dominant Vegetation Type and Treatment Alternative within the Colorado Desert Bioregion

Dominate Vegetation Type	WUI	Fuel Breaks	Ecological Restoration	Total by Dominate Vegetation Type
Tree-Dominated	2,806	9,328	48,840	**60,975**
Shrub-Dominated	112,413	217,758	41,801	**371,973**
Grass-Dominated	4,366	764	637	**5,767**
Total by Treatment	**119,585**	**227,851**	**91,279**	**438,715**

4.2.2 EFFECTS

This section analyzes the potential impacts of implementing the proposed project or alternatives to wildlife, aquatic species, and vegetation resources as well as invasive species.

4.2.2.1 Significance Criteria

Based on the CEQA Guidelines and mandatory findings of significance and other applicable wildlife protection laws, a project would have a significant impact on wildlife, aquatic species, and vegetation and in relation to invasive species if it would:

- Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by CDFW or USFWS;
- Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, and regulations or by CDFW or USFWS;
- Have a substantial adverse effect on federally protected wetlands, as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool coastal, etc.), through direct removal, filling, hydrological interruption, or other means;
- Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites;
- Conflict with any County, City, or local adopted policies, ordinances or General Plan protecting biological resources, such as a tree preservation policy or ordinance;
- Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional or state habitat conservation plan.

Under the Federal Endangered Species Act, activities may not result in the take, direct or indirect, of a special status species. Direct take involves the killing of a special-status plant or animal. Indirect take includes the alteration of habitat, harassment, and any other activity that may contribute to the reduction in numbers of a special status species. Only indirect take, due to alteration of habitat by invasive non-native species, is applicable to activities affecting special status species under the Proposed Program or the Alternatives.

For the purpose of this Program EIR, the following thresholds are used to determine whether there is a significant effect to botanical, wildlife, aquatic and invasive species or resources as a result of implementation of treatments under the Program or any of the Alternatives. A significant effect occurs when there is a:

a) Threat to eliminate a plant community.
b) Violation of any state or federal wildlife protection law
c) Contribution either directly (through immediate mortality) or indirectly (through reduced productivity, survivorship, genetic diversity, or environmental carrying capacity) to a substantial, long-term reduction in the viability of any native species or subspecies at the state level.
d) Adverse effect, either directly or through habitat modification, on any species identified as a special status species in local or regional plans, policies, or regulations, or by CDFW or USFWS.
e) Net effect in a local project area was a substantial increase in the population of invasive species AND this occurred on over 10 percent of a WHR lifeform in a bioregion.
f) Creation of a public nuisance.

4.2.2.2 Data, Assumptions, and Approach to Bioregional Analysis

Implementation of the proposed program may result in impacts to vegetative communities, wildlife habitat, aquatic habitat, and invasive species. CNDDB is a system designed to enable the management, visualization, and analysis of biogeographic data collected by CDFW and its Partner Organizations. In addition, CNDDB facilitates the sharing of those data within the CNDDB community. CNDDB integrates GIS, relational database management, and ESRI's ArcIMS technology to create a statewide, integrated information management tool that can be used on any computer with access to the Internet (https://www.wildlife.ca.gov/).

VEGETATION

Impacts to botanical resources were analyzed by examining special-status plants and communities listed in the California Natural Diversity Database (CNDDB) database for each bioregion. SPR BIO-2 requires VTP applicants to use the most appropriate databases for biological information, including but not limited to CNDDB, CWHR or BIOS, to check for occurrences of special status plants in their project area and provide this scoping information to the wildlife agencies.

The Natural Resources Agency and CDFW have developed guidelines for assessing the effects of proposed projects on rare, threatened, or endangered plants and natural communities entitled “Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities” (CDFW, 2009). The California Native Plant Society has also developed botanical survey guidelines – “CNPS Botanical Survey Guidelines” (CNPS, 2001).

These measures as explained above are designed to reduce the potential impacts to vegetation to less than significant.

WILDLIFE

Effects of fuel reduction on wildlife depend on the specific ecological requirements of individual species and thus are difficult to generalize, especially in a treatment area as large and complex as that considered here. Furthermore, responses of wildlife to fuel reduction treatments have not been studied extensively and information on many taxonomic groups are lacking. Direct and indirect effects on wildlife are likely to differ. As a rule, negative effects will be greatest on species dependent on the fuels being removed, while positive effects will be greatest on species that have evolved in fire-dependent and other disturbance-prone ecosystems.

Effects of a given treatment will be influenced greatly by characteristics of adjacent parcels. An isolated patch of habitat will take much longer to recover from treatment than one surrounded by similar habitat. Treatments occurring near similar habitat will likely have less impact on wildlife, as the surrounding habitat will provide displaced animals somewhere to flee and facilitate their return to the treated area post-project as conditions become suitable.

To address potential direct and indirect effects of the VTP on wildlife in an ecologically meaningful way, species have been represented by four broad guilds (subterranean (soil invertebrates, burrowing mammals, etc.), ground-dwelling (terrestrial invertebrates, reptiles and amphibians, including partially aquatic forms, and mammals), shrub-dwelling (shrub-nesting birds, etc.), and arboreal (arboreal invertebrates, cavity and tree nesting birds and mammals, etc.) based on how they typically use the vertical environment. Shaffer and Laudenslayer (2006) used similar guilds in addressing effects of fire on animals, but they considered shrub-dwelling species as a subset of arboreal fauna. Since many of the treatments considered here specifically target either scrub habitats or the shrub layer in wooded habitats, we have elevated shrub species to their own guild. We feel such an approach is preferable to addressing broad taxonomic guilds wherein species occupy the full range of available vertical strata because fuel reduction treatments in structurally complex habitats are typically layer-specific. Species are assigned to a single guild based on their primary or most critical (for instance, breeding or over-wintering) use area.

Prescribed fire will be the most common treatment type used to reduce fuels under the Proposed Program and thus, will have the most-wide-ranging effects on wildlife throughout the treatment area. Because nearly all of California’s vegetation types are fire-adapted (Sugihara et al., 2006), restoring fire to these communities should be mostly beneficial to wildlife so long as consideration is given to the natural fire regime on the landscape (Huff et al., 2005). Furthermore, prescribed fire treatments are typically low-intensity and patchy, resembling natural fire conditions more than the stand-replacement fires that often occur as a result of fire suppression. However, temporal and spatial effects as well as the short- and long-term effects that fire will have on the animals residing within these landscapes need to be considered (Shaffer and Laudenslayer 2006).

Mechanical treatments typically are applied on a scale smaller than that of prescribed fire treatments, comparable to that of most biological treatments (browsing and grazing), and larger than that of manual treatments.

Although all the acreage available for treatment under the VTP is suitable for manual treatment, it is labor-intensive and time-consuming; thus expensive and therefore expected to be implemented primarily in relatively small areas where other treatments are unfeasible. Given the relatively low impact of this treatment type and limited extent to which it is likely to be implemented, its cumulative impact on wildlife is expected to be extremely low. However, certain mitigation measures are still appropriate to minimize or avoid potential impacts.

Herbivory treatments also could be used in every VTP project. Their negative impact on wildlife is expected to be small, assuming that effects can be contained within intended treatment areas (that is, that livestock are confined and do not spread invasive plants). Managed livestock grazing can increase the productivity of selected species, increase the nutritive quality of the forage, and increase habitat diversity (Vavra 2005).

While each of the various treatment types proposed in this program come with potential negative direct and/or indirect effects on wildlife, one must weigh these effects against the known effects on wildlife from catastrophic high severity wildfire; which in most cases in California is the inevitable eventual consequence of lack of fuel reduction coupled with fire suppression. In general, direct wildlife mortality due to fire is low since most animals are able to escape or take shelter (Lawrence 1966, Smith 2000) however stand-replacement can displace many animals, often over a huge area (greatly exceeding the area proposed for any VTP project), and set habitat succession back. Negative effects on wildlife of any well planned, implemented, and monitored VTP project are likely to be minor in comparison, highlighting the need to perform more managed fuel reduction activities.

Over 600 special-status wildlife taxa occur in California, and over 300 occur in habitats likely to be treated under the VTP. In accordance with SPR's BIO-2, BIO-3, and BIO-4 a CNDDB query will need to be conducted at the project level and potential impacts to special-status taxa evaluated during the environmental review and completion of the environmental checklist.

For the purpose of this bioregional analysis, adverse effects were considered to be significant if they would affect taxa that are listed as either threatened or endangered at the federal or state level.

In order to analyze the potential effects of implementing the Program or Alternatives it was necessary to consider the types of treatments proposed, the extent of those treatments and the SPR's and PSR's included in the VTP that are designed to mitigate potential impacts to wildlife species (Section 2.6).

Impacts to wildlife species as a result of the proposed project will be mitigated with the implementation of SPR's and PSR's. This will reduce the potential impacts to wildlife to less than significant.

AQUATIC

The average annual acreage proposed for treatment within the VTP in the first decade is 60,000 acres (0.2 percent of the total acreage of California). This means that there will be very few projects spread over many acres, and the probability of numerous projects occurring in a single watershed is very low, even over 10 years. The treatment types, proportions by bioregion and percent of watersheds in varying disturbance classes are listed in Chapter 2 for the Program and Alternatives.

The aquatic species most likely to be affected by VTP projects include 34 species or distinct populations of fish and 12 species or distinct populations of amphibians listed as Endangered or Threatened at the state or federal level (CDFW, 2012). Most species have evolved with disturbances of varying types and magnitudes, including fire, and are able to recover from them (Thode et al., 2006). All of the listed aquatic species are sensitive to changes in water quality in respect to biologic resources, though their individual and population-level resilience differs between species. Temperature, sediment and peak flows are the primary water quality parameters affecting aquatic species that could be altered by VTP treatments. In addition to these changes in water quality characteristics, physical changes to riparian vegetation and in-stream habitat may also affect aquatic communities (Thode et al., 2006). The underlying assumption in the following analysis is that if changes to water quality, riparian habitat and in-stream physical habitat are not significant then adverse impacts to aquatic species are unlikely.

Direct impacts to aquatic species that occur within saline and fresh emergent wetlands, lacustrine, riverine, and estuarine habitat types are unlikely because these habitat types are excluded from treatment. Riparian and upland vegetation types adjacent to these excluded vegetation types may be treated and indirect effects are possible.

In order to analyze the potential effects of implementing the Program or Alternatives it was necessary to consider the types of treatments proposed, the extent of those treatments and Standard Program Requirements (SPR's) BIO-10, BIO-11, BIO-12, HYD-1, HYD-2, HYD-3, HYD-4, HYD-5 HYD-6, HYD-7, HYD-8, HYD-9, HYD-10, HYD-11, HYD-12, HYD-13, HYD-14, HYD-15, HYD-16, & HYD-17 included in the VTP that are designed to moderate potential impacts to water quality.

INVASIVE SPECIES

The impacts from non-native invasive species are analyzed by changes in the structure and composition of these populations in relation to vegetation in the dominant natural plant community types. The effects of VTP projects can be analyzed as long as they are distinguishable from presumed changes in the pre-existing plant community composition without any VTP projects. The additive effects of past actions (such as wildfire suppression, timber harvest, mining, nonnative plant introductions, and ranching) have shaped the present landscape and corresponding populations of special status and invasive species.

For purposes of this analysis, beneficial effects are those where invasive non-native plants are either eradicated or their abundance and diversity are significantly reduced in relationship to native species. A significant beneficial impact would be a major reduction of invasive non-native plant populations sufficient to enable the natural plant community to dominate treated areas within the short-term (2-5 years).

Adverse effects are those where invasive non-native plants are able to either successfully invade or reinvade treatment areas and establish viable populations, either because the treatments prepared hospitable site conditions or left viable populations of invasive non-native plants intact and able to increase in extent. A significant adverse impact would be a major increase in population sufficient to enable invasive non-native plants to dominate the natural plant community within the short-term (2-5 years).

PSR's identified during project development and SPR's BIO-8 & BIO-9 (described at the end of this sub chapter) will reduce the potential impact from invasive species resulting from the implementation of projects to less than significant. These include watercourse buffer zones, protection of special status plants & plant populations through CDFW consultation, utilization of an integrated pest management approach, and utilization of only weed free straw and mulch.

4.2.2.3 **Direct Effects Common to all Bioregions from Implementing the Program/Alternatives**

Implementation of the proposed program will impact vegetative community's wildlife habitats aquatic habitats and invasive species in similar ways throughout the state. Discussion of those impacts common to all bioregions follows.

VEGETATION

Plant communities to be treated under the VTP have been subject to fire for centuries. It has been the primary disturbance regime in most California ecosystems, and many plant species have evolved in the presence of recurrent fires. As a result, many plant species reproduce most successfully following fire, which makes their continued success and abundance dependent on fire. To the extent that VTP treatments mimic the natural disturbance patterns of the vegetation type to which they are applied, it is reasonable to expect the long-term impacts of treatments to be beneficial. However, at the individual project level, there is always the possibility of harming or damaging individuals of a species during treatment implementation. In many cases, the treatments in non-forested vegetation types will return all or a portion of the treated area to an early successional stage, killing off disturbance intolerant species, and freeing up resources such as light and nutrients for early successional species, such as perennial grasses and forbs (USDI BLM, 2005).

In order to avoid direct take of individual special-status plant taxa, SPR’s BIO-3 and BIO-4 will apply to each project ensuring that a DFW biologist, USFWS, or a qualified biologist will be required to review and propose measures that will mitigate to a level less than significant and avoid take, and the measures will be incorporated into the project design. At the program scale the question for this EIR is whether or not the habitats of common natural communities and special-status plants and communities are negatively impacted over the long-term. This can be determined by first analyzing the direct effects of the treatments from an individual project and then by expanding these effects to the bioregional scale to determine the proportion of the habitat types to be affected per decade. In order for an effect to be considered significant at the bioregional level, the species in question would have to be impacted enough to meet one of Significance Criteria stated above. The amount of habitat that would have to be adversely modified to cause a substantial adverse effect has not been scientifically determined for most species and is likely unknowable until the threshold has been crossed and the species is in jeopardy.

WILDLIFE

Direct effects are those of the treatment procedure itself (i.e., during and shortly after treatment) as opposed to those that are a function of the desired fuel condition. Direct effects to special status wildlife taxa due to fuel reduction treatments are inherently adverse and will not vary much between bioregions. Some potential exists for substantial adverse effects, however implementation of SPR’s ADM-1 and ADM-2 which require that prior to the start of operations, the project coordinator shall meet with the contractor to discuss all resources that must be protected using SPR’s. Additional protection is implement through BIO-1 - BIO-7 which requires that projects shall be designed to avoid significant effects and avoid take of rare, threatened, and endangered species. The project coordinator shall run a nine-quad search or larger search area and write a summary of all special-status species identified in the biological scoping. A CAL FIRE Environmental Coordinator will analyze impacts to CNDDB species and submit the summary and preliminary report for consultation. The vegetation treatment projects that are not deemed necessary to protect critical infrastructure or forest health in San Diego, Imperial, Riverside, Orange, Los Angeles, Ventura, Santa Barbara, Kern, and San Bernardino counties shall adhere to special requirements. In shrublands containing native oaks, treatments may incorporate retention of older, acorn producing oaks and establish buffers around any special status animal, nest site, den location, or plant within the project area will reduce the potential for impacts to wildlife.

Direct effects are highly dependent on a treatment method and will have the most adverse effect on species with limited mobility and those that are disturbance intolerant. The direct effects discussed should be compared with the direct effects to wildlife that would result from catastrophic wildfire likely to occur in the absence of treatment.

AQUATIC

VTP treatments have the potential to affect aquatic species via impacts to water quality, quantity, and modification of aquatic habitats directly and indirectly. Treatments may have adverse effects on aquatic species, including: riparian function, headwater stream ecosystems, headwater habitat relationships, sources and recruitment methods for large woody debris (LWD), detritus (e.g. leaf litter) production, stream bank stability, sediment control and transport, stream shading, and microclimate at a local level. However direct impacts to aquatic species that occur within saline and fresh emergent wetlands, lacustrine, riverine, and estuarine habitat types by causing elevated stream temperatures, increased sediment loads, fecal coliform contamination, or elevated peak flows are unlikely because these habitat types are excluded from treatment. Riparian and upland vegetation types adjacent to these excluded vegetation types may be treated and indirect effects are possible. However, implementation of PSR's and SPR's would limit the extent of these impacts and would ensure that impacts would remain at the less-than-significant level. Specifically, BIO-10 requires that if water drafting becomes a necessary component of the proposed project, drafting sites shall be planned to avoid adverse effects to special-status aquatic species and associated habitat, in-stream flows, and depletion of pool habitat. Screening devices shall be used for water drafting pumps, and pumps with low entry velocity shall be used to minimize removal of aquatic species, including juvenile fish, amphibian egg masses and tadpoles, from aquatic habitats. In addition, BIO-11 requires that aquatic habitats and species shall be protected through the use of watercourse and lake protection zones, as described in California Forest Practice Regulations (14 CCR) (WLPZ's) and other operational restrictions. Please see HYD-3 for these standard protection measures. Finally, BIO-12 requires that if a watercourse crossing is necessary, a CDFW

Streambed Alteration Agreement shall be obtained and any BMPs identified in the agreement shall be incorporated into the project. Implementation of the SPRs will reduce the potential for impacts to aquatic species.

INVASIVE SPECIES

Invasive non-native plant species can be threats to natural habitats in California. Many of these species colonize habitats following ground disturbance when seeds are introduced from regions where these species are common, from the disturbance of legacy seeds in the soil, and from adjacent areas where colonization has already occurred. The introduction of invasive non-native species into natural habitats is considered a potentially significant impact.

Most notably, invasions have altered fuels, and therefore fire regimes, in many ecosystems. Grasslands previously characterized by frequent surface fires have been converted to shrublands and woodlands as fire suppression has facilitated establishment of native woody plants. Simultaneous alterations in fuel have decreased fire frequencies in former grasslands, and have contributed to high-intensity crown fires in some woodlands (McPherson, 2002). Fire can also facilitate non-native plant invasion by reducing competition from native species and increasing the availability of soil nutrients.

Invasive plant species occur predominantly in plant communities subject to periodic natural disturbance such as stream channels, in areas adjacent to development (e.g. coastal bluffs, coastal terrace, valley bottoms), and in areas where native species cover and natural regeneration has been displaced, thereby providing an opening for non-native species invasions (USDI National Park Service, 2005). This situation can occur as a result of some VTP projects, particularly prescribed burning and associated fire lines. An unintended consequence of extensive fuel break construction and maintenance may be the establishment of non-native plant species.

Although there is some variability in numbers and types of invasive plants between bioregions, all bioregions contain non-native plants with the potential to act as seed sources for the spread of invasive species.

Disturbance is considered one of the primary factors promoting non-native invasion (Rejmanek, 1989; Hobbs and Huenneke, 1992), and a number of studies have documented an association of non-native plant species with disturbed areas similar to fuel breaks, such as logging sites, roads, trails, and pipeline corridors (D'Antonio et al. 1999).

In many cases, non-native species are well adapted to fire and can invade fire-prone ecosystems, particularly when natural fire regimes have been altered through fire suppression, increased human-caused ignitions, or by feedback effects from changes in plant species composition (D'Antonio and Vitousek, 1992; Brooks et al., 2004). Merriam et al. (2006) conducted a study of plant species composition on fuel breaks in a variety of habitats around California. They found that non-native plants were present in 49 percent of the study plots, but differed significantly between vegetation types. Fuel breaks in coastal scrub habitats had the highest relative non-native cover (68.3% +/- 4.0%), followed by chaparral (39.0% +/- 2.4%), oak woodland (25.0% +/- 2.5), and coniferous forests (4.0% +/- 1.1%) (Merriam et al., 2006).

Other relevant conclusions of their study are that non-natives become increasingly dominant over time and may thrive on fuel breaks because they can more easily tolerate frequent disturbances caused by fuel break maintenance. Fuel breaks may act as points of introduction for non-natives because they receive external inputs of nonnative seeds through vehicles, equipment, or humans traveling on them (Schmidt, 1989; Lonsdale and Lane; 1994). Equipment may disperse the seeds of non-native plants into fuel breaks during construction and maintenance. The establishment of invasive plants within fuel treatments is a serious concern because many treated areas extend into remote, pristine wildland areas. If invasive species can establish a seed source in fuel breaks, adjacent wildland areas might become more susceptible to widespread invasion, particularly following widespread disturbances such as natural or prescribed fires (Merriam et al., 2006).

Implementation of BIO-8 which requires that only certified weed-free straw and mulch be used if needed to prevent the inadvertent introduction of invasive species, and BIO-9 which requires that the project coordinator determine if there is a significant risk of introducing invasive plants and if so develop specific mitigation measures using principles outlined in the document "Preventing the Spread of Invasive Plants: Best Management Practices for Land Managers (3rd edition" or other relevant documents) would result in less-than-significant impacts related to the potential for introduction of invasive plants. Specific examples of these practices include Planning BMPs, Project Materials BMPs, Travel BMPs, as well as Tool, Equipment and Vehicle Cleaning BMPs. Waste Disposal BMPs and Soil Disturbance BMPs.

4.2.2.3.1 Prescribed Fire

VEGETATION

Fire suppression activities can also have a detrimental affect on ecological processes such as soil compaction and erosion, water sedimentation, chemical pollution, biodiversity and the introduction of invasive species (FRAP, 2010). As a result, preplanning with strategic fuel treatments could reduce the potential detrimental impacts from suppression activities.

All of the common natural communities that might be treated under the proposed VTP have evolved under some degree of natural or human-induced fire. The Proposed Program will reintroduce fire into communities where fire has been excluded through past suppression or control efforts. Generally, prescribed fire is believed to benefit the overall health of fire adapted ecosystems (McKelvey et al. 1996). The reintroduction of a simulated natural fire regime will help maintain structural and species diversity, benefiting the overall habitat value of the community for plants and wildlife. When conducted at the appropriate time, prescribed fire can open up densely vegetated areas, encourage growth of suppressed species, contribute to nutrient cycling, increase species diversity, and increase the diversity of the vegetation’s age structure.

The following list includes some adaptations to fire and examples of native California species that exhibit these adaptations (adapted from Biswell, 1989):

- Thick, platy bark—ponderosa pine;
- Corky bark, which is a poor conductor of heat energy—Douglas-fir and white-fir;
- Epicormic branching (i.e., trunk and stem sprouts)—coast redwood and many oaks;
- Basal sprouting—oaks;
- Serotinous cones, which drop seeds only when heated sufficiently—knobcone pine, Monterey pine, and some cypresses;
- Stump sprouting after fire—chamise and some manzanitas;
- New shoots from underground rhizomes—yerba santa;
- Seeds that can remain dormant for many years until heat of fire enables them to germinate—species of manzanita, flannelbush, and ceanothus;
- Location of growing points at or below ground level—some perennial grasses;
- Sprouting from buried corms or bulbs—some perennial members of the lily and onion families.

The responses of plants to fire can be divided into two broad categories – stimulated by fire or not stimulated by fire. “Fire-stimulated plants are further divided into fire-dependent and fire-enhanced categories, while plants not stimulated by fire are either fire-neutral or fire-inhibited. Fire dependent responses occur only with fire, such as seed germination requiring heat, smoke, or chemicals from charcoal. Fire-enhanced responses (e.g. sprouting) are those that are increased by fire but that also occur from other types of damage to the plant (Sugihara et al., 2006).

Prescribed fires can be designed and implemented to leave bare mineral soil that is favorable to seedling establishment of fire-stimulated plants, however they generally do not, especially when they are light underburns or in areas where there is a substantial duff component. Although mortality of some individual plants will occur, most woody plants and species with adaptations to fire will persist through prescribed fire treatments that simulate the natural fire regime. The overall vegetative characteristic of the plant community will be maintained.

Prescribed fire treatments that do not mimic the natural regime may adversely affect the reproductive capability or viability of a natural community. The response of a plant community to fire is determined by the fire-response categories of its constituent plant species. The season of the burn can affect plants at a sensitive stage of development and may reduce seed production and recruitment that year. For example, each plant species in a community responds differently to the seasonal timing of prescribed burns or wildfires. Chamise (Adenostema fasciculatum) and red shank (Adenostema sparsifolium) are two shrub species commonly found in chaparral communities and they have different patterns of growth, flowering, and fruiting. This leads to early spring fires causing greater mortality in chamise than red shank and a potential shift in the species composition of that community (Sugihara et al., 2006).

The spatial pattern of the burn or other treatment also affects the plant population response. Patterns of intensity and severity range from variable and complex to continuous and uniform. “At one extreme, a fire with uniform intensity will have uniform effects, either positive or negative, on the survival, age-class distribution, abundance, and distribution of individuals in a population. At the other extreme, a complex fire, with variable intensity, will have varied effects on a plant population within the area burned. Crown fires tend to be more uniform, whereas surface fires more complex” (Sugihara et al., 2006).

In addition, the existing distribution of individuals of a species – endemic, patchy, or continuous – greatly affects how the plant population responds to an individual fire event. Even fire neutral and fire-inhibited species can fare well if their distribution is continuous. This is particularly true if the spatial pattern of the burn is variable and complex as is more typical in an understory burn than a crown fire (Sugihara et al., 2006).

Burn intensity is also an important factor in how a plant community responds to fire. “High-Intensity fires can often lead to plant communities with lower diversity and increased dominance of a few species” (Sugihara et al., 2006). This occurs by favoring species, which are fire-stimulated in reproduction and establishment, such as chamise. Under the program, these effects would only be expected under prescribed fire in the herbaceous and shrub types where burn intensity is similar to a wildfire.

Large burns have a greater chance of negatively affecting a plant population than small burns due to the potential of large burns to interrupt seed dispersal mechanisms (Sugihara et al., 2006). This fact makes wildfires have potentially much greater impact on plant populations than prescribed burns. Over the past eight years 97.6 percent of the total acreage burned in wildfires was the result of fires greater than 300 acres. On the other hand, the average VTP project size of 260 acres is small in comparison to most wildfires, which often exceed 10,000 acres. Therefore VTP projects are unlikely to eliminate a sub-population, of even a fire-inhibited species, and prevent re-colonization of the area.

A change in the fire frequency in a community through either fire suppression or prescribed burning may change the species composition, spatial structure, nutrient cycling, and canopy structure of the community. For example, fire suppression in the 20th century has affected the ecological processes, spatial patterns, and species composition in some communities (Chang, 1996). In some cases, fire-inhibited species such as white fir (Abies concolor) are now dominant trees in forest stands that were historically dominated by fire-tolerant species such as ponderosa pine (Pinus ponderosa). This has significantly altered the spatial structure of these forests from a canopy of large trees with an open understory into dense thickets of young growth occupying the understory.

The changes in vegetative and ground cover from prescribed burning in surface/mixed fire regime habitat types are expected to be less than the impacts in habitats with a crown fire regime. Habitats with more than one canopy layer generally experience less intense fires than chaparral and grassland communities. In general, vegetation types with multiple canopy layers and vertical diversity, such as conifer and hardwood forests, are adapted to a high frequency/low intensity surface/mixed fire regime, and vegetation treatments tend to mimic this effect by focusing on understory treatments. Prescribed burning in the understory is generally low intensity with a patchy distribution making it very unlikely to have a significant long-term impact on even small populations of common plants or special status plants and communities.

On the other hand, grasslands and chaparral are adapted to a low frequency/high intensity crown fire regime. Many chaparral species germinate much better after stimulated by fire such as sugar bush (Rhus ovata), sumac (Malosma laurina), chamise, manzanita (Arctostaphylos spp), yerba santa (Eriodictyon spp.), and ceanothus (Ceanothus spp.) (CAL FIRE, 1981). “In general, there is a high proportion of species with fire-stimulated and fire-dependent germination (e.g., desert ceanothus) and species with strong fire response sprouting (e.g. chamise) in plant communities and bioregions with shrub crown fire regimes, such as chaparral in the Central Coast and South Coast bioregions” (Sugihara et al., 2006). In these types VTP prescribed burning treatments have similar intensity and pattern as the natural fire regime, but they may be implemented more frequently than the plant community is naturally adapted to. One of the most significant areas of concern at the state-wide program level is the potential effect of burning too often in the chaparral habitat type. The non-sprouting species may be eliminated from a stand by fires occurring at such short intervals that the seedlings germinating after the first fire do not have time to produce a crop of seed before the next fire (CAL FIRE, 1981).

The conventional wisdom used to be that chaparral types naturally burned every 10-15 years, and under the CMP it has been common to reburn chaparral types to maintain grazing lands at least this frequently. However, research published in the last 10 years indicates that the natural fire return interval in most chaparral types is much longer than previously thought. Historical records suggest a pre-suppression model of burning in chaparral landscapes of many modest-sized summer lightning-ignited fires that burned a relatively small portion of the landscape, punctuated one to two times a century by massive autumn Santa Ana wind-driven fires (Keeley, 2006). This is also supported by the historical record of infrequent and large Santa Ana fires as well as the life history characteristics of many dominant woody species in chaparral that are favored by long fire-free intervals and inhibited by fire return intervals of a decade or less (Keeley, 2006).

Wildfires have resulted in vegetation type conversions where aggressive, exotics, and/or non-native invasive species were present prior to the fire and dominated the site after fire. Sagebrush (Artemisia spp.), low sage (Artemisia arbuscula), bitterbrush (Purshia tridentata), juniper (Juniperus spp.), and pinyon-juniper vegetation types are particularly susceptible to type conversion if cheatgrass or medusa-head are well established in them. Type conversion is most likely when a high severity fire completely consumes the existing dominant vegetation (Billings, 1994; Peters and Bunting, 1994; Rasmussen, 1994). The aggressive nature of cheatgrass and medusa-head puts the native shrubs and trees at a competitive disadvantage, preventing them from successfully reestablishing (Billings, 1994; Monsen, 1994). Because of the widespread occurrence of cheatgrass in these community types, the potential exists for accidental type conversion. However, implementation of SPR’s BIO-8 and BIO-9 which requires that only certified weed-free straw and mulch be used, and for the project coordinator to determine whether there is a significant risk of introducing invasive species, and if so develop mitigation measures using principles outlined in the California Invasive Plant Council’s “Preventing the Spread of Invasive Plants: Best Management Practices for Land Managers (3rd edition)” (2012)(see Appendix B), or other relevant documents will reduce the potential for prescribed fire to cause type conversion to less than significant. Examples include Planning BMPs project Materials BMPs, Travel BMPs, Tool, Equipment and Vehicle Cleaning BMPs, Clothing, Boots and Gear Cleaning BMPs, Waste Disposal BMPs and Soil Disturbance BMPs.

In summary, habitat types within the treatment area of the VTP and the plants within them generally are adapted to some pattern of wildfires. The main difference between wildfire and prescribed fire is the ability to control important parameters of the burn including the season, the size, the fire intensity, and the frequency. The potential for substantial adverse effects from prescribed fire are most likely to occur in the conifer woodland, hardwood woodland, herbaceous, and shrub habitat types due to problems with invasive species, impacts to regeneration, burn intensity, canopy removal and burn frequency. PSR's identified during project development as well as SPR's BIO-8 & BIO-9, as explained above and listed at the end of this sub-chapter, are designed to reduce the potential impacts to vegetation to less than significant. The small proportion of the plant communities being treated under the VTP, makes any long-term effects to the plant communities and special- status plant taxa highly unlikely.

OAK WOODLANDS

Plant responses to fire vary greatly and are often determined by a complex interaction among external factors such as temperature, soil moisture, and heat duration, intensity of burn, and season of burn (Chang, 1996). For the first few years after a wildland fire, vegetation is comprised of individuals from the following categories (Brown and Smith, 2000):

- Plants that survived the fire with their form intact
- Sprouts or suckers that grew from the base or buried parts of top-killed plants
- Plants that established from seed, which can be further subdivided into:
- Plants that re-established from seed dispersed from surviving plants (usually trees)
- Plants that re-established from seed dispersed from off of the burned site
- Plants that re-established from fire-stimulated seed within the soil seed bank
- Plants that re-establish from seed that developed on plants that sprouted after the fire.

Oak trees primarily sprout from the base of top killed trees, making them resilient after fires. Most seedlings and many saplings, but very few mature oaks, are top killed by fire. However there is variability among species as described below.

Prescribed fire in oak and hardwood woodlands can result in eventual mortality from fire-induced cavities through which rot can enter that can spread quickly along hardwood stems and lead to breakage (Brown and Smith, 2000). Fires are exceptionally damaging to live oak stands, because most species in these stands are susceptible to fire damage. In particular, canyon live oak, interior live oak (Q. wislizenii), sycamore (Platanus spp.), and cottonwood (Populus spp.) have fairly thin bark and are easily top killed by fire (Chang, 1996). However, live oaks are particularly vigorous resprouters compared to deciduous oaks, and will likely sprout back from their base even when all of the above ground portion has been killed (McCreary, 2004). In contrast to the live oaks, mature deciduous oaks (black oak, white oak, blue oak, valley oak, etc.) have thick fire resistant bark and are able to withstand low intensity burns (McCreary, 2004), but don’t sprout as vigorously as live oaks when killed.

Small blue oaks (and perhaps other species) are susceptible to top kill during prescribed fire conditions. Bartolome et al. (2002) observed 100 percent top kill of blue oak regeneration that was between 40 and 70 cm tall and less than 10 years old. No stimulatory response of regeneration was observed when comparing burned to unburned sites; that is, sprouts recovering from burning did not grow faster or more vigorously than sprouts that had not been burned as has been hypothesized by some. Bartolome et al. (2002) concluded that at the study site “for successful regeneration into the sapling stage, small plants must be protected from burning and browsing for ten or more years.”

Oak tree size (height and diameter) heavily influences the likelihood of surviving a fire, due to elevation of live foliage and bark thickness. Blue oak trees greater than 8 inches diameter at breast height (dbh) were observed to have 75-100 percent survival after wildfire, while trees 4-8 inches dbh had only 10-90 percent survival (Horney et al., 2002).

It should be noted that effects from wildfire or prescribed fire can create valuable wildlife habitat, such as cavities that can be used for denning and dead branches that provide foraging habitat for woodpeckers, etc. A small to moderate amount of damage to residual overstory trees can serve to increase rather than decrease the biological diversity within many vegetation types.

Prescribed fire in oak woodland rangelands is highly variable due to differences in oak bark thickness, tree structure, and sprouting response. Individual survival is also influenced by understory composition and the degree of fire intensity (Brown and Smith, 2000). Blue oak acorn survival and germination can be negatively affected by fire; however, the positive association between blue oak ages and fire dates suggests a temporal concentration of post-fire sprouting. The low rate of recruitment since the 1940s may be partly due to fire suppression and grazing (Brown and Smith, 2000).

In Northern Oak woodlands (Holland, 1986) prescribed fire is likely to kill young Douglas-fir regeneration, which retards conversion to mixed evergreen stands and is beneficial to persistence of oak woodland habitats (Barnhart et al., 1996). However, fire in oak woodlands is also likely to top kill most oak seedlings and saplings and retard oak regeneration by ten or more years, which is the time it will take oaks to resprout and grow to their pre-fire heights and diameters (Swiecki and Bernhardt, 2002).

Blue oak (Quercus douglasii), the most abundant hardwood forest type in California, has sapling populations that may be insufficient to maintain current stand densities (Bolsinger, 1988; Muick and Bartolome, 1987; Swiecki and Barnhart, 1999). Although many species of native California oaks are relatively fire resistant, either due to innate low fuel conditions or to vegetative adaptation, fire may not play as much of a role in regeneration as once thought, neither enabling nor preventing regeneration (Bartolome et al, 2002; Lang, 1988). However, frequent fires can compromise re-sprouting from saplings and seedling advance regeneration. According to Swiecki (1999), "A combination of frequent fires and annual livestock grazing would be a prescription for eliminating blue oak regeneration."

SPR BIO-6 requires applicants to promote species diversity, retain older, acorn producing oaks to create deer forage and to improve wildlife habitat. In shrublands containing native oaks, BIO-8 requires that only certified weed-free straw and mulch shall be used if needed to mitigate project impacts. BIO-9 requires the project coordinator develop mitigation measures using principles outlined in the California Invasive Pest Council's "Preventing the Spread of Invasive Plants: Best Management Practices for Land Managers (3rd edition)" (2012), or other relevant documents, if there is a significant risk of introducing invasive plants. When properly implemented, these SPRs should help reduce the impacts of prescribed fire to these vegetation types.

Prescribed fire in these types usually does not result in more than 20 percent canopy reduction in the overstory, and can often maintain or improve growth of remaining trees by reducing competition from understory trees and shrubs for scarce water resources. PSR's identified during project development as well as Implementation of SPR's BIO-6 which requires that in shrublands containing native oaks, treatments may incorporate retention of older, acorn producing oaks to create deer forage. CAL FIRE or applicants may plant other vegetation to promote species diversity and improve wildlife habitat, when such practices are not in conflict with program goals, BIO-8 which requires that In order to reduce the spread of new invasive plants species, only certified weed-free straw and mulch shall be used. During the planning phase BIO-9 requires that if the project coordinator determines that there is a significant risk of introducing invasive plants, then project specific mitigation measures shall be developed using principles outlined in the document "Preventing the Spread of Invasive Plants: Best Management Practices for Land Managers (3rd edition" or other relevant documents). Coordination of the mitigations will also include consultation with CDFW, will reduce the impact to Oak Woodlands less than significant.

WILDLIFE

In general, direct wildlife mortality due to fire is low because most animals are able to escape or take shelter (Lawrence, 1966; Smith, 2000). However, animals with limited mobility such as mollusks, salamanders, and the young of more mobile species may be impacted from fire. Because natural fires in California occur mostly in the late summer and fall, animals have adapted to this seasonal pattern by nesting and rearing their young during the spring and early summer. If seasonal activity patterns of these species are not taken into consideration and burning occurs during the spring or summer while immobile young are present, then wildlife mortality associated with burning may be high. Unfortunately, fires can get out of control during late summer and fall and so it is necessary to weigh the possibility of negative long-term effects to wildlife habitat and destruction of human development against the short-term effects of wildlife mortality.

Direct effects from disturbance may also have deleterious effects on wildlife within and adjacent to burn areas. For instance, wildlife may be disturbed by the presence of a large crew required to be on site during a prescribed burn in order to control it and keep it within the planned boundary. Additionally, noise from helicopters occasionally used to ignite fires or smoke drifting over a nest or den site may cause wildlife to leave the area. Control lines also may need to be established around the perimeter of the fire causing disturbances addressed above in the mechanical and manual treatment sections. Of particular concern, though, are the short-term consequences of burning near special-status taxa where disturbance may cause reproductive failure. In areas where other types of vegetation treatments are successfully implemented,

Implementation of SPR’s ADM-1, which requires that prior to the start of operations, the project coordinator shall meet with the contractor to discuss all resources that must be protected using standard project requirements (SPR’s), ADM-2, which requires that prior to the start of operations, and at the discretion of the project coordinator, a registered professional forester (RPF) shall flag and/or fence all protected resources for avoidance during operations, BIO-1 which requires that projects shall be designed to avoid significant effects and avoid take of rare, threatened, and endangered species, as defined in CEQA Guidelines Section 15380, BIO-2 which requires that the project coordinator shall run a nine-quad search or larger search, BIO-3 which requires that the project coordinator shall write a summary of all special-status species identified in the biological scoping including the CNDDB search with a preliminary analysis & BIO-4 which requires that the project coordinator shall ensure that a CAL FIRE Environmental Coordinator analyze impacts to CNDDB species and any PSR measures identified during project development will reduce impacts to rare, threatened, and endangered species to less than significant. These requirements also relate to “habitat of significant value” and “environmentally sensitive habitat areas” as per CEQA and California Coastal Act, respectively.

AQUATIC

The use of backing prescribed fire within riparian zones is permitted within the Watercourse and Lake Protection Zone (WLPZ) using SPR HYD-3 which requires a watercourse and lake protection zone to be established on each side of all Class I and II watercourses that is equal to the standard widths specified in the current California Forest Practice Rules and fifty foot Equipment Limitation Zones (ELZ) to be established for Class III watercourses as well as HYD-4 which prohibits direct ignition of project activity fuels within the WLPZ or ELZ's. According to Rinne and Jacoby (2005) direct mortality of fish due to burning has only been documented in high severity fires that burned through small streams with high fuel loading. Similarly, Pilliod et al. (2003) noted that direct mortality of amphibians due to natural fire is rare due to timing and/or their ability to exploit refugia from fire. High severity fires resulting in mortality of aquatic species are very unlikely to occur under prescribed burning conditions. In fact, use of prescribed fire or other vegetation treatment techniques is intended to reduce the occurrence of high severity wildfires.

In one of the few studies of prescribed burning in riparian systems in the Western U.S., Beche et al. (2005) found that low to moderate intensity fire ignited in the riparian zone had "minimal effects on a small stream and its riparian zone during the first year post-fire." Impacts from fire to riparian vegetation, LWD, fine sediment, water chemistry, periphyton (see Glossary) and macro-invertebrates were considered. The study was conducted in the Western Sierra Nevada Mountain Range on the Blodgett Forest Research Station. There were no significant changes in in-stream macro-invertebrate communities after the prescribed fire, which is important because macro-invertebrates are often used as an index of biological health for other aquatic species (Beche et al., 2005). In a more recent, but still similar study conducted on the Payette National Forest in Idaho, Arkle and Pilliod (2010) concluded, "Despite steep topography, erosion-prone soils, and sampling directly within the burned area, we found no immediate (1–3 month) or delayed (3 years) effects of the prescribed fire on the biotic and abiotic characteristics of the study stream."

It appears highly unlikely that prescribed fires used in VTP treatments in riparian areas and wet areas (see Glossary) will burn hot enough to directly harm aquatic species that live within the water column. Implementation of PSR's as well as SPR's HYD-3 which requires that a WLPZ shall be established on each side of all Class I and II watercourses that is equal to the standard widths specified in the current CA Forest Practice Rules (Table 2.6-1). Fifty foot ELZ's shall be established for Class III watercourses. Vegetation within the WLPZ or ELZ will not be disturbed by project activities, with the exception of backing prescribed fire. Class IV watercourse protections shall be PSR's specified in the PSA, and designed in conjunction with any recommendations from RWQCB staff & HYD-4 which requires that no direct ignition shall be allowed within the WLPZ or ELZ's. However, it is acceptable for a fire to enter or back into a WLPZ's or ELZ's will reduce the potential for impacts to aquatic species to less than significant.

INVASIVE SPECIES

Fire can be used to either control invasive species or to restore historical fire regimes. However, the decision to use fire as a management tool must consider the potential interrelationships between fire and invasive species. Historical fire regimes did not occur in the presence of many invasive plants that are currently widespread, and the use of fire may not be a feasible or appropriate management action if fire-tolerant invasive plants are present (Brooks and Pyke, 2001). The use of prescribed burning to reduce non-native plant populations can be complicated by the positive effect of fire on many invasive plants, and the subsequent effects of invasive pants on post-fire establishment by native species. In a series of controlled burns in Sequoia Kings Canyon National Park, Keeley et al. (2003) found that non-native plant species respond positively to fire in conifer forests, and this response is greater under higher intensity fires (D'Antonio et al., 2002). This would mean the effects from a cooler burning prescribed fire would be preferable to the effects from a wildfire of higher intensity.

Invasive alien grasses especially benefit from fire, and promote recurrent fire, in many cases to the point where native species cannot persist and native plant assemblages are converted to alien-invaded annual grasslands (Brooks & Pyke, 2001). The management of fire and invasive plants must be closely integrated for each to be managed effectively.

A recent thorough study of the relationship between fire and invasive species in California is in a chapter from "The Landscape Ecology of Fire" (Keeley et al., 2011). Essentially, it is much more complicated than previously understood. Some of the conclusions are worth including here:

- Fires are natural ecosystem processes on many landscapes. Perturbations to the fire regime, such as increased fire frequency and fire suppression, are the real "disturbances" to these systems and can lead to alien plant invasions.
- In forests, both too little fire and too much fire can enhance invasions. Restoration of historical fire regimes may not be the best way to balance these two risks.

- Repeated fires in shrub lands decrease fuel volumes, decrease fire intensity and increase alien plant invasion. Decreasing fire frequency may be the best means of reducing alien invasions.
- Prescription burning that targets noxious species in grasslands is often not sustainable unless coupled with restoration.

4.2.2.3.2 Manual Treatments

VEGETATION

Treatment of common natural communities by hand clearing will directly affect these communities through the removal or disturbance of natural vegetation, resulting in reduced overall cover or greatly reduced understory with no impact to the canopy. Manual techniques can be used in many areas with minimal environmental impacts. Although they have limited value for weed control over a large area, manual techniques can be highly selective. Manual treatment can be used in sensitive habitats such as riparian areas, areas where burning or herbicide application would not be appropriate, and areas that are inaccessible to ground vehicles (USDI BLM, 1991a). Because of the expense of these treatments, hand clearing will be used on a limited basis. Hand treatments in areas with special status plants and communities will be limited to small areas scattered throughout the state.

Because of the lack of heavy equipment and the greater control workers have in implementing hand treatments, there is little chance of adverse effects from these treatments as long as SPR's ADM-1 and ADM-2 are adhered to. ADM-1 requires the project coordinator to meet with the contractor to discuss all resources that must be protected using project specific requirements (PSR's). ADM-2 requires that prior to the start of operations, and at the discretion of the project coordinator, a registered professional forester (RPF) will flag and/or fence all protected resources for avoidance during operations. PSR measures identified during project development as well as implementation of SPR's BIO-1 which requires that projects shall be designed to avoid significant effects and avoid take of rare, threatened, and endangered species, BIO-2 which requires that the project coordinator shall run a nine-quad search or larger search area, BIO-3 which requires that the project coordinator shall write a summary of all special-status species identified in the biological scoping, BIO-4 which requires that the project coordinator, shall ensure that a CAL FIRE Environmental Coordinator analyze impacts to CNDDB species, and shall submit the summary and preliminary analysis to the CDFW, USFWS, and [if applicable] NOAA Fisheries for consultation, would ensure that impacts to rare, threatened, and endangered species would be less than significant. These requirements also relate to "habitat of significant value" and "environmentally sensitive habitat areas" as per CEQA and California Coastal Act, respectively.

OAK WOODLANDS

Impacts of hand treatments on forest and rangeland composition and structure are expected to be minimal, as most treatments are expected to selectively remove only non-oak species of understory shrubs, small trees, etc. As a result, impacts are expected to be positive because a decrease in competition for water and nutrients should improve forest and rangeland productivity. Hand treatments are expected to be especially beneficial to Northern Oak Woodlands by selectively removing Douglas-fir while retaining oak regeneration. PSR's identified during project development as well as Implementation of SPR's BIO-6, BIO-8, & BIO-9 will ensure that impacts to Oak Woodlands would be less than significant. BIO-6 requires that in shrublands containing native oaks, treatments may incorporate retention of older, acorn producing oaks to create deer forage. CAL FIRE or applicants may plant other vegetation to promote species diversity and improve wildlife habitat, when such practices are not in conflict with program goals. BIO-8: requires that in order to reduce the spread of invasive plants, only certified weed-free straw and mulch shall be used if needed to mitigate project impacts. BIO-9: requires that if the project coordinator determines that there is a significant risk of introducing invasive plants, then project specific mitigation measures shall be developed using principles outlined in the document "Preventing the Spread of Invasive Plants: Best Management Practices for Land Managers (3rd edition" or other relevant documents). Examples include Planning BMPs project Materials BMPs, Travel BMPs, Tool, Equipment and Vehicle Cleaning BMPs, Clothing, Boots and Gear Cleaning BMPs, Waste Disposal BMPs and Soil Disturbance BMPs. Coordination of the mitigations will also include consultation with CDFW.

WILDLIFE

Manual treatments typically have a gentler immediate impact on the environment than either fire or mechanical treatments. There is very little potential for direct mortality of wildlife from this treatment type. However, there is still considerable potential for disturbance, especially when power tools are used (see Section 4.2.2.3.3 Mechanical Treatments). Workers implementing manual treatments may traverse and disturb sensitive habitats such as talus slopes, rock outcrops, and streambeds that are inaccessible to fire and machinery. However, implementation of SPR's ADM-1, which requires that prior to the start of operations, the project coordinator shall meet with the contractor to discuss all resources that must be protected using standard project requirements (SPR's) and ADM-2, which requires that prior to the start of operations, and at the discretion of the project coordinator, a registered professional forester (RPF) shall flag and/or fence all protected resources for avoidance during operations, aswellas BIO-1 which requires that projects shall be designed to avoid significant effects and avoid take of rare, threatened, and endangered species, as defined in CEQA Guidelines Section 15380, BIO-2 which requires that the project coordinator shall run a nine-quad search or larger search area, BIO-3 which requires that the project coordinator shall write a summary of all special-status species identified in the biological scoping including the CNDDB search with a preliminary analysis, identifying which species would be affected by the proposed project & BIO-4 which requires that the project coordinator, shall ensure that a CAL FIRE Environmental Coordinator analyze impacts to CNDDB species, and shall submit the summary and preliminary analysis to the CDFW, USFWS, and [if applicable] NOAA Fisheries for consultation and any PSR measures identified during project development will reduce impacts to rare, threatened, and endangered species to less than significant. These requirements also relate to "habitat of significant value" and "environmentally sensitive habitat areas" as per CEQA and California Coastal Act, respectively.

AQUATIC

Manual treatments typically have a gentler immediate impact on the environment than either fire or mechanical treatments. There is very little potential for direct mortality of aquatic species from this treatment type. Workers implementing manual treatments may traverse and disturb sensitive habitats such as talus slopes, rock outcrops, and streambeds that are inaccessible to fire and machinery. However, implementation of SPR's ADM-1 which requires the project coordinator to meet with the contractor to discuss all resources that must be protected, ADM-2 which requires that prior to the start of operations, and at the discretion of the project coordinator, an RPF will flag and/or fence all protected resources for avoidance during operations, along with HYD-4 which specifies that no direct ignition of project activity fuels is allowed within the WLPZ or ELZ's and HYD-8 which states that when possible, onsite native vegetative material (e.g. cut material) will be utilized for mulching bare soil, as well as any PSR's identified during project development will reduce impacts to aquatic species to less than significant.

INVASIVE SPECIES

In many cases, non-native species are well adapted to fire and can invade fire-prone ecosystems, particularly when natural fire regimes have been altered through fire suppression, increased human-caused ignitions, or by feedback effects from changes in plant species composition (D'Antonio and Vitousek, 1992; Brooks et al., 2004). Merriam et al. (2006) conducted a study of plant species composition on fuel breaks in a variety of habitats around California. They found that non-native plants were present in 49 percent of the study plots, but differed significantly between vegetation types. Fuel breaks in coastal scrub habitats had the highest relative non-native cover (68.3% +/- 4.0%), followed by chaparral (39.0% +/- 2.4%), oak woodland (25.0% +/- 2.5), and coniferous forests (4.0% +/- 1.1%).

Fuel breaks thinned with rubber-tired logging equipment and chainsaws had significantly lower relative non-native cover than fuel breaks constructed by either bulldozers or hand crews. It is apparent that bulldozers scraping off the duff layer and/or topsoil created conditions favorable to invasive species, but why non-native cover was higher in fuel breaks constructed by hand crews is not so clear. The study found that environmental variables significantly associated with non-native species presence and abundance, including overstory canopy, litter cover, and duff depth, were significantly lower on fuel breaks than in adjacent wildlands. These findings suggest that fuel break construction and maintenance strategies that retain some overstory canopy and ground cover may reduce the establishment and widespread invasion of non-native plants (Merriam et al., 2006). It also suggests that fuel break maintenance projects may need to include noxious weed eradication as an integral component.

Other relevant conclusions of their study are that non-natives become increasingly dominant over time and may thrive on fuel breaks because they can more easily tolerate frequent disturbances caused by fuel break maintenance. Fuel breaks may act as points of introduction for non-natives because they receive external inputs of nonnative seeds through vehicles, equipment, or humans traveling on them (Schmidt, 1989; Lonsdale and Lane, 1994). Equipment may disperse the seeds of non-native plants into fuel breaks during construction and maintenance. The establishment of alien plants within fuel treatments is a serious concern because many treated areas extend into remote, pristine wildland areas. If alien species can establish a seed source in fuel breaks, adjacent wildland areas might become more susceptible to widespread invasion, particularly following widespread disturbances such as natural or prescribed fires (Merriam, Keeley, and Beyers; 2006).

PSR's identified during project development and SPR's BIO-8 & BIO-9 as described at the end of this sub chapter will reduce the potential impact from invasive species resulting from the implementation of projects to less than significant. These include watercourse buffer zones, protection of special status plants & plant populations through CDFW consultation, utilization of an integrated pest management approach, and utilization of only weed free straw and mulch.

4.2.2.3.3 Mechanical

VEGETATION

Mechanical treatment involves the use of vehicles such as masticators, wheeled tractors, crawler-type tractors, or specially designed vehicles with attached implements designed to cut, uproot, or chop existing vegetation. The selection of a particular mechanical method is based upon access, equipment's availability, and characteristics of the vegetation, such as seedbed preparation and re-vegetation needs, topography and terrain, soil characteristics, and climatic conditions.

Treatment by mechanical clearing of common natural communities will directly affect these communities through the removal or disturbance of natural vegetation, resulting in reduced cover in some areas.

Mechanical treatments will be applied to substantially fewer acres than will prescribed burns. In grasslands and shrub lands, the construction of shaded fuel breaks by disking, mowing, or mastication are examples of mechanical treatments. The majority of all vegetative cover would be removed when mechanically treating herbaceous or shrub habitat types, creating the potential for adverse effects to plant resources. The level of impacts will be proportional to the acres treated.

In areas of forested vegetation, mechanical fuel reduction will focus on removing ladder fuels formed by smaller trees and shrubs while maintaining large overstory trees. The reduction in ground level and mid-canopy vegetation may result in a change in species composition of groundcover where small trees (less than ten inches dbh) and shrubs make a substantial contribution to canopy cover. Treatments that leave substantial amounts of litter and slash on the ground can inhibit establishment and growth of many herbaceous species – especially those that are fire-stimulated but also add to the intensity and severity when wildfire does visit the next time. So the tradeoff is that litter and slash are problematic in fire prone areas.

Mastication treatments in particular sometimes generate heavy loadings of woody fuel on the ground, which may inhibit the germination and establishment of shrubs, but also reduces richness of native understory species. Mastication of surface and ladder fuels results in a short to medium term increase in fire severity potential. In a recent mastication effects study, fuel treatments where the masticated material was partially removed by incorporation into the soil or prescribed burning, resulted in greater understory species establishment, but also resulted in higher abundance of fire-stimulated shrubs (Kane et al., in press). If prescribed fire were planned to follow mastication, then the potential for colonization by exotic species would be high due to the more severe burn that would result (Bradley et al., 2006). Severe burns consume a much greater portion of the native vegetation increasing recovery time and creating opportunity for invasive species if they exist nearby. Research shows that time since fire is the most critical factor in alien invasion and colonization. Apparently, it is the closed canopy of pre-fire shrublands that reduces alien populations and thus limits the alien seed bank present at the time of fire (Bradley et al., 2006).

In summary, mechanical treatments have the potential for significant effects in all lifeforms since there is no comparable natural disturbance to which individual plants or communities have adapted over time, and because of the high level of disturbance to canopy cover and the soil layer. Whether these adverse effects are significant at the program level depends on the proportion of a lifeform treated and the geographic distribution of the treatments. These are evaluated in the next section.

OAK WOODLANDS

Mechanical treatments include tractor piling slash created from handwork, mowing down understory herbaceous vegetation, and mastication of understory shrubby plants. None of these treatments are likely to have significant impacts on mature, overstory oak trees. All of them are likely to retard oak regeneration by removing aboveground portions of seedlings and saplings. Implementation of SPR’s ADM-1 (requiring the project coordinator to meet with the contractor to discuss all resources that must be protected using PSR’s and specify the resource protection measures and details of the burn plan in the incident action plan (IAP) and attend the pre-operation briefing to provide further information) and ADM-2 (requiring that prior to the start of operations, and at the discretion of the project coordinator, a RPF will flag and/or fence all protected resources for avoidance during operations will followed) will ensure that equipment operators avoid large saplings and small trees.

Mastication can range from limited impacts where masticators move between trees and large shrubs grinding up vegetation in small openings, to treatments where substantial areas are treated and soil disturbance is relatively high. Impacts from mastication can be highly correlated to the amount of vegetation on-site prior to treatment. SPR BIO-6 is intended to help retain overstory cover of oaks in hardwood rangelands.

Mastication, when combined with prescribed burning or followed closely by wildfire may increase residual overstory mortality compared to leaving understory brush untreated. Bradley et al. (2006) reported that mastication of understory brush did not reduce fuels in the short term (less than two years) but rather rearranged them, resulting in a 200 percent increase in 1-hr and 1000-hr size classes and a 300 percent increase in 10-hr and 100-hr size classes in the fuel bed. The concentration of fuels in the fuel bed and hotter burn resulted in significantly increased overstory mortality of black oak and canyon live oak in the Pole (less than eight inch) and overstory (greater than eight inch) size classes compared to adjacent areas that were not masticated prior to burning. However, where understory brush and small trees form fuel ladders to the overstory, prescribed burning without pre-treating the understory vegetation (reducing its height) can also result in significant damage to overstory trees. If understory fuels are removed or allowed to decompose prior to burning there is not likely to be significant damage to overstory trees.

PSR's identified during project development as well as Implementation of SPR's BIO-6, BIO-8, & BIO-9 will reduce the impact to Oak Woodlands less than significant. These include requiring retention of older, acorn producing oaks to create deer forage, requiring that in order to reduce the spread of invasive plants, only certified weed-free straw and mulch shall be used if needed to mitigate project impacts and that if the project coordinator determines that there is a significant risk of introducing invasive plants, then project specific mitigation measures shall be developed using principles outlined in the document "Preventing the Spread of Invasive Plants: Best Management Practices for Land Managers (3rd edition" or other relevant documents). Examples include Planning BMPs project Materials BMPs, Travel BMPs, Tool, Equipment and Vehicle Cleaning BMPs, Clothing, Boots and Gear Cleaning BMPs, Waste Disposal BMPs and Soil Disturbance BMPs.

WILDLIFE

Unlike fire treatments, mechanical treatments typically leave, and in many cases create, considerable amounts of litter and debris, which then are often piled and/or burned. In fact, mechanical treatments are often used as a precursor to fire treatments by making fuel more manageable and creating control lines. Machines typically are noisier, and move more slowly than, prescribed fire, alerting animals to the danger and allowing them time to escape; however, the noise itself may create a disturbance to sensitive wildlife not produced by other treatment types. Such disturbance may result in increased risk of predation or nest failure or disruption of essential behaviors. When mechanical treatments are applied when soils are relatively dry their potential for direct effects is relatively low for amphibians but relatively high for most other upland wildlife. Due to the varying climates throughout the state, mechanical treatments can be applied any time of the year with the exception of Red Flag Warnings and the presence of excessive soil moisture on the project site. In areas where other types of vegetation treatments are successfully implemented, following any PSR measures identified during project development as well as implementation of SPR's ADM-1, ADM-2, and BIO-1 through BIO-4, will reduce impacts to rare, threatened, and endangered species to less-than-significant. These requirements also relate to “habitat of significant value” and “environmentally sensitive habitat areas” as per CEQA and California Coastal Act, respectively.

INVASIVE SPECIES

Mastication treatments can also create a risk of invasive species colonization and spread. Mastication of surface and ladder fuels results in a short to medium term increase in fire severity potential. If prescribed fire were planned to follow mastication, then the potential for colonization by exotic species would be high due to the more severe burn that would result (Bradley et al., 2006). Severe burns consume a much greater portion of the native vegetation, increase recovery time for native species, and create opportunity for non-natives to invade if they exist nearby. Research shows that time since fire is the most critical factor in alien invasion and colonization. Apparently, it is the closed canopy of pre-fire shrublands that reduces alien populations and thus limits the alien seed bank present at the time of fire (Bradley et al., 2006).

PSR’s identified during project development and SPR’s BIO-8 & BIO-9 as described at the end of this sub chapter will reduce the potential impact from invasive species resulting from the implementation of projects to less than significant. These include watercourse buffer zones, protection of special status plants & plant populations through CDFW consultation, utilization of an integrated pest management approach, and utilization of only weed free straw and mulch.

4.2.2.3.4 Herbivory Treatments

VEGETATION

Herbivory is a natural process that has influenced the evolution of plants for millennia. Along with fire, it was the first vegetation management tool ever applied by humans. Herbivory, or grazing, is a constant influence on all natural plant communities. Every plant species varies in its ability to survive and prosper in a grazed ecosystem. Most established plants are not killed with a single grazing event that removes its foliage, flowers, and stems. Rather, plants have evolved mechanisms that reduce their likelihood of being grazed or promote their regrowth after grazing (Hendrickson and Olsen, 2006).

The effects of grazing on individual plants can be difficult to predict because plants grow in complex ecosystems that are subject to seasonal and yearly fluctuations in weather and natural disturbances. Plants differ in their ability to tolerate or compensate for grazing. The ability of a plant to regrow after grazing depends on its age and physiological condition, stage of development, and carbohydrate allocation patterns. In addition, competition with other plants for space, soil nutrients, and water can influence how a plant responds to grazing (Hendrickson and Olsen, 2006).

A plant's ability to recover after grazing depends largely on its ability to reestablish leaves and renew photosynthesis. Plants tolerant of grazing generally have an abundant supply of viable meristems or buds that can be quickly activated to initiate regrowth if water and nutrients are available (Hendrickson and Olsen, 2006).

Grasses are different from forbs and shrubs in how they respond to grazing because of where their growing points or meristems are located. Grasses maintain apical and axillary buds near the base of the plant until flowering is initiated.

On the other hand, forbs and shrubs have axillary buds all along the stem and apical buds at the tips of branches. These meristems are readily available to herbivores and can be removed throughout the plant's life. Some forbs and shrubs have numerous growing points in the root crown at the base of the plant that can produce new shoots or underground runners called rhizomes. Shrubs and rhizomatous herbs would not be affected by short-term grazing since the plants would only be knocked back rather than killed.

Plant phenology, or how plants grow through the season, should be considered when using grazing to manage vegetation. A plant's growth stage will determine how it responds to grazing. For example, most grasses and forbs tolerate early-season grazing, a time when soil moisture and nutrients needed for regrowth are abundant (Hendrickson and Olsen, 2006).

There is ample research to indicate that grazing is actually beneficial to many native herbaceous species – including those linked with special habitats such as vernal pools (Hayes and Holl, 2006; Marty, 2005). Vernal pools are poorly drained depressional features that occur throughout California in grassland areas underlain by a hardpan or clay pan layer that restricts percolation of water through the soil. They are significant for special status plants and communities because they contain a very high degree of diversity with more than 100 species of endemic plants (Marty, 2005).

Research conducted on the effects to vernal pool habitat on the 12,362-acre Howard Ranch property in eastern Sacramento County demonstrated that the relative cover of native plant species remained highest in continuously grazed plots, while declining in those where grazing was removed (Marty, 2005). Grazing removal did not affect the cover of native vegetation in the pools themselves but did negatively impact native cover in both the edge and upland zones.

It was also found that the change in native richness per quadrat over the first three years of the study was positive in grazed pools and negative in ungrazed pools. There was a decline in diversity with the removal of grazing after only three years, and this effect was most significant on the edge (Marty, 2005).

Another important habitat for native plants is the coastal prairie ecosystem. Over the last twenty to thirty years one quarter of the California coastline has been set aside in conservation status leading to the removal and cessation of livestock grazing. Now annual wildflowers, many of which are rare and endangered, are found more commonly on private lands adjoining conservation lands (Hayes and Holl, 2006).

Hayes and Holl found that annual forb species richness and cover increased significantly with grazing on the California coastal prairie sites analyzed. This may be due to decreased vegetation height and litter depth. Grasses show mixed responses to grazing, and exotic forb abundance increases with grazing (Hayes and Holl, 2006).

Overall, prescribed herbivory is not likely to have an adverse effect in any of the habitat types in the VTP, and in many cases will be beneficial to plant communities. PSR's identified during project development as well as SPR's BIO-8 & BIO-9, as listed and explained at the end of this sub-chapter, are designed to reduce the potential impacts to vegetation to less than significant.

OAK WOODLANDS

In contrast to forested settings where goats are more likely to be used, cattle are more likely to be used in oak woodlands. The stock type, intensity, duration and season of use will vary in response to site conditions and project objectives.

Prescribed herbivory in oak woodlands can result in localized reduction in advance regeneration of oaks, but is not likely to result in impacts to overstory trees. In one study the authors concluded that, "in rangeland seasonally stocked with moderate cattle densities, planting sites must be protected from cattle browsing and trampling in order to successfully restock valley oak" (Bernhardt and Swiecki, 1997). In the same study though, the authors noted that cattle grazing on Harding grass, which competes for water and nutrients with oak seedlings, resulted in increased growth rates for oak seedlings that had been caged to protect them from cattle.

Timing of herbivory affects potential damage to oak seedlings and saplings. Generally late spring and summer grazing are most damaging to oak regeneration due to cattle preference for green living oak leaves rather than the dry forage that is available this time of year. In one study, early spring grazing (March) resulted in minimal grazing of oak regeneration compared to grazing later in the season (May, June, July) (Jansen et al., 1997).

PSR’s identified during project development as well as Implementation of SPR’s BIO-6, BIO-8, & BIO-9 will reduce the impact to Oak Woodlands less than significant.

WILDLIFE

The level and nature of potential direct effects on native wildlife of fuel treatments using livestock are similar to those of manual treatments, though perhaps more concentrated and intense. There is some potential for disturbance but little for mortality beyond that already present from native ungulates.

Following any PSR measures identified during project development as well as implementation of SPR’s ADM-1, ADM-2, and BIO-1 through BIO-4, will reduce impacts to rare, threatened, and endangered species to less-than-significant. These requirements also relate to “habitat of significant value” and “environmentally sensitive habitat areas” as per CEQA and California Coastal Act, respectively.

AQUATIC

Effects of manual treatments or prescribed herbivory treatments to aquatic organisms are reduced to a less-than-significant impact through the utilization of mitigations such as SPR’s ADM-1, ADM-2, and BIO-11 and any PSR’s. Direct contamination of the water column due to fecal runoff from prescribed herbivory treatments is unlikely to occur due to the requirement that program participants follow SPR ADM-1 requiring the project coordinator to meet with the contractor to discuss all resources that must be protected using project specific requirements (PSR’s) and specify the resource protection measures and details of the burn plan, in the incident action plan (IAP) and attend the pre-operation briefing to provide further information. ADM-2 requires that prior to the start of operations, and at the discretion of the project coordinator, a RPF will flag and/or fence all protected resources for avoidance during operations, and BIO-11 mandates that aquatic habitats and species shall be protected through the use of watercourse and lake protection zones, as described in California Forest Practice Regulations (14 CCR) (WLPZ’s) and other operational restrictions.

INVASIVE SPECIES

The prescribed grazing or herbivory will have a range of vegetation treatment goals, with the reduction of invasive plants being an important one. The challenges of controlling invasive plants on rangelands include vast roadless areas that limit access for weed control. These challenges limit the feasibility of chemical and mechanical treatments and favor use of biological control (Launchbaugh, 2006). An unknown proportion of herbivory treatments will target the spread of non-native species, and this proportion will vary between alternatives. Overall, prescribed herbivory treatments are expected to have a net beneficial effect on the status of non-native plant populations since livestock will often be used to reduce the spread of non-native seeds in livestock, from the movement of animals during implementation of projects. Prescribed grazing is an effective technique, rivaling traditional chemical and mechanical control methods, for the management of deleterious invasive plants including leafy spurge, spotted knapweed, yellow star thistle, cheat grass, salt cedar, and kudzu (Pittroff, 2006). Prescribed grazing is viewed as an “environmentally friendly” alternative to traditional methods because it leaves no chemical residue, does not utilize potentially toxic substances, and can mimic natural disturbance processes.

Current research is beginning to lay the foundation for herbivory management strategies capable of being (a) selective against undesired species, and (b) selective in favor of desired species. Thus, understanding prescribed herbivory (and prescribed fire, for that matter) as planned disturbances and studying their effects on plant communities has the potential to significantly contribute to better understanding of ecosystem level processes underpinning weed invasion (Pittroff, 2006).

There is variation in growth curves and life cycles amongst plants in all plant communities. The timing and intensity of herbivory can be used to fine-tune and steer grazing selectivity. In particular, goats are extremely selective and thus ideally positioned to become rather highly specific bio-control agents (Pittroff, 2006).

Implementation of BIO-8 which requires that only certified weed-free straw and mulch be used if needed to prevent the inadvertent introduction of invasive species, and BIO-9 which requires that the project coordinator determine if there is a significant risk of introducing invasive plants and if so develop specific mitigation measures using principles outlined in the document “Preventing the Spread of Invasive Plants: Best Management Practices for Land Managers (3rd edition” or other relevant documents) would result in **less-than-significant impacts** related to the potential for introduction of invasive plants. Specific examples of these practices include Planning BMPs, Project Materials BMPs, Travel BMPs, as well as Tool, Equipment and Vehicle Cleaning BMPs. Waste Disposal BMPs and Soil Disturbance BMPs.

4.2.2.3.5 No Treatment

VEGETATION

Stand-replacing wildfire is likely to occur eventually in most California ecosystems in the absence of fuel reduction. Direct effects of catastrophic wildfire on plant communities are overwhelmingly negative.

WILDLIFE

Stand-replacing wildfire is likely to occur eventually in most California ecosystems in the absence of fuel reduction. Such wildfires kill or displace most of the animals present and destroy their nests and often their shelters. A few predatory animals may benefit in the short term from the prey exposed, injured, or killed by these fires, but direct effects of catastrophic wildfire on animals are overwhelmingly negative.

AQUATIC

Research indicates that high intensity wildfire has the potential to indirectly harm aquatic life through impacts to water quality; peak flows and stream channel morphology. The Proposed Program would help to reduce the detrimental environmental effects of wildfire to watersheds and thus to aquatic lifeforms by helping reduce fire severity across the landscape.

The potential direct adverse impacts to aquatic resources are not likely to vary by bioregion for the same reasons as described above for the entire state, i.e. PSR's, SPR's, and low intensity of prescribed burns.

Most VTP treatments are essentially less intense versions of wildfire and timber harvest, and the potential types of indirect impacts are considered to be similar. However, due to lack of monitoring of fuel management treatments and little focus by researchers on this topic, the indirect impacts of these treatments on aquatic ecosystems is largely unknown (Thode et al., 2006). Thus, much of the analysis in this chapter is via inference from effects of wildfire or timber harvest in comparable environmental settings.

In reference to wildfire Rinne and Jacoby (2005) listed the primary indirect impacts to fish (including listed salmonids) in watercourses as: changes in stream temperature due to understory and overstory plant removal, ash-laden slurry flows, increases in flood peak flows, and sedimentation due to increased landscape erosion. Shaffer and Laudenslayer (2006) noted that significant impacts to salmonids after fires are "generally linked to changes in watershed hydrology after a large proportion of drainage is burned and little vegetation or woody debris remains on the landscape." There has been less research regarding effects from fire on lakes or small ponds, but the available information indicates minimal impacts to fish or amphibians following wildfire (Shaffer and Laudenslayer, 2006). Murphy (1995) listed the following indirect mechanisms by which timber harvest has impacted anadromous salmonids: decreased shade, decreased supply of LWD, addition of slash to streams, stream bank erosion, altered stream flow, increased erosion, increased nutrients, barriers to migration, and inputs of fine organic and inorganic sediment. BLM (2005) described potential impacts to fish from fire as the short-term effects of fire on fish populations are a function of both the degree and duration of fire-caused changes in water quality and quantity, and the proportion of each inhabited stream network affected by burning. An isolated or fragmented fish population would recover far more slowly from any adverse effects of burning than would a population inhabiting a widespread and well-connected stream system.

The water quality and quantity impacts described above for wildfires and timber harvest may occur sporadically at the local level due to VTP treatments. In most cases, VTP treatments are relatively small in area (average treatment size is 260 acres) and do not affect a large proportion of any stream network - unlike some wildfires or extensive timber harvest. The relative isolation of specific populations of fish or other aquatic species would have to be considered at the site-specific level, and specific protection measures devised, if significant impacts to water quality or habitat were expected.

The non-water quality and quantity related impacts potentially caused by timber harvest and wildfire described above include input of slash to streams, decreased supply of LWD, and creation of migration barriers. Because of the stream protection PSR's and SPR's included in the VTP, there should be no input of slash into streams from treatments. Slash created during VTP treatments is typically left in place, chipped, or piled and burned, not placed in streams. Road building and construction/reconstruction of stream crossings are not funded activities within the VTP, so crossings will not be impacted positively or negatively, and unplanned installation of fish migration barriers in stream channels (e.g. from poorly installed culverts) should not occur under the Program or Alternatives.

Supplies of LWD from streamside recruitment zones will not be significantly impacted by VTP treatments because overstory trees are neither subject to removal nor to high mortality rates from prescribed fire. LWD within stream channels will not be burned up during prescribed fires or removed during mechanical treatments. Beche et al. (2005) noted that only 4.4 percent of trees ranging in size from 11.7 to 40.4 cm dbh were killed due to prescribed burning in riparian forests and the prescribed burn did not change the amount or movement of LWD in the channel. Minor amounts of overstory tree mortality due to prescribed burning could be viewed as a benefit to aquatic species, because it provides a moderately accelerated recruitment mechanism for LWD.

Beche et al. (2005) observed that percent bare ground increased from 3.5% (+/- 8.2%) pre-fire to 34.2% (+/- 21.8%) post-fire due to a prescribed fire in a riparian zone. However, fine sediment in pools adjacent to the burned riparian areas and wet areas as measured by V* (the average residual pool volume of fine sediment), did not significantly change post-fire. The author also measured sediment composition (percent finer than 11.3 mm) as well as longitudinal and cross section surveys of channel morphology. None of the sediment or channel morphology metrics indicated a change due to the prescribed fire in the riparian zone. The author attributed this to the fact that the fire only removed surface vegetation from 70 percent of the total area burned, which was only 14 percent (18 hectare) of the total watershed area (129 hectare). The prescribed burn retained a considerable amount of litter and surface vegetation on site, which would reduce surface erosion. A wildfire would likely affect a larger percentage of a given watershed, and leave relatively less litter and surface vegetation in place.

Mechanical and prescribed fire treatments in crown fire regime vegetation types tend to result in low vegetative cover and high extent of bare ground after treatment, both of which can lead to increased sediment delivery rates and higher peak flows. Also, the lack of an overstory tree canopy in the riparian zone in crown fire regime vegetation types means that reductions in riparian vegetation density due to treatment have a higher likelihood of altering the riparian microclimate, i.e. decreased humidity and increased air temperatures. However, changes in riparian microclimate conditions are not likely to change water column temperatures because the overwhelming determinant of water temperature is direct solar exposure, not ambient air temperature (Beschta et al., 1987).

INVASIVE SPECIES

The impacts from non-native invasive species are analyzed by changes in the structure and composition of these populations in relation to vegetation in the dominant natural plant community types. The effects of VTP projects can be analyzed as long as they are distinguishable from presumed changes in the pre-existing plant community composition without any VTP projects. The additive effects of past actions (such as wildfire suppression, timber harvest, mining, nonnative plant introductions, and ranching) have shaped the present landscape and corresponding populations of special status and invasive species. One of the most extensive influences invasive plants can have on an ecosystem is to alter their fire regimes. As invasive species move into ecosystems, their intrinsic fuel properties, which involve the plant’s flammability and ignition potential, and extrinsic fuel properties, which relates to how the plants are arranged on the landscape, both can directly influence fuel loads, fire frequency, intensity and seasonality, and burn continuity. These changes in fire regimes can alter a plant community and even transform entire ecosystems, allowing the invasive species to take over the entire community and also lead to new opportunities for more invasive species to colonize or expand their habitat (Brooks et al., 2004). Annual nonnative Eurasian grasses now dominate 98 percent of California grasslands (Barbour et al., 2007). Nonnative Bromus spp., like cheat grass, rip gut, and red brome frequently convert native coastal and desert shrubland communities into annual grasslands (Brooks et al., 2004). The finely textured grasses produce fuels that dry quickly under low soil and low atmospheric humidity conditions and increase the horizontal fuel continuity and fuel bed bulk density which promotes ignitions and fires earlier in the spring and later in the fall than normal fire regimes, often increasing the fire season and changing the ecosystem’s historical infrequent fire interval of 60 to 100 years to a rapid 3 to 5 year interval (Barbour et al., 2007). The invasive grasses are able to exploit these changes in the fire regime by more quickly establishing than the native species in the post fire disturbed areas, and eventually the original components of the plant community have been changed, and in turn alters the entire ecosystem. Once the fire frequency of native shrub landscapes has gone through these type conversion transformations, they may never recover because of changed factors such as soil nutrients and high densities of the invaders’ seed banks (Brooks et al., 2004). These new communities burn more rapidly and frequently, which affects animals that are dependent on this landscape for forage and cover, such as the sage grouse, black-tailed jack rabbit, and Paiute ground squirrel, which in turn affects predators that depend on these species for food, such as golden eagles and prairie falcons. Fast moving fires are lethal to native reptiles such as snakes and desert tortoises, which are killed in these circumstances (Brooks et al., 2004).

There are fewer invasive species found in California’s montane conifer forests than shrub and grasslands, however these ecosystems are also experiencing negative changes from invasive plants, largely due to unintended side effects from past and current management practices. Practices such as logging, livestock grazing, and fire suppression have allowed for unusually high woody fuel accumulation and has changed forest systems from surface fire to more intensive crown fires, altering forest fire regimes. If a forest in these altered conditions experiences a wildfire, large crown gaps are created and adult trees and cones are diminished or destroyed, so new tree generation can be slow because normal seed dispersal mechanisms are not functioning. This allows for invasive species to establish. Post fire management can also promote invasive species in conifer forests. The common practice of using herbicides to suppress shrubs in order to reduce competition with new seedlings actually interferes with the natural seral stages of nitrogen fixing shrub establishment, which normally prepares the soil for seedling growth. With the absence of shrubs, invasive annual grasses have a better chance of establishing, which diminishes habitat and food sources for small mammals and eventually alters the fuel structure, fire frequency, and thus entire fire regime (Keeley et al., 2011).

4.2.2.4 Effects and Goals of the Proposed Program and Alternatives

Because the scale of Alternatives A, B, C, and D would be the same as the Proposed VTP at 60,000 treated acres for ten years, with the same vegetation treatment activities by vegetation type expected to occur, Alternatives A, B and C would have similar impacts to biological resources as the proposed VTP. The No Project Alternative and Alternative D would each treat approximately half the acres as the Proposed VTP, and Alternative D would use substantially less prescribed fire as the other Alternatives. A brief discussion of each relative to biological resources is found at the end of this section.

VEGETATION

All of the common natural communities that might be treated under the proposed VTP have evolved under some degree of natural or human-induced fire. The Proposed Program will reintroduce fire into communities where fire has been excluded through past suppression or control efforts. Plants stimulated by fire are fire-dependent and fire-enhanced categories, while plants not stimulated by fire are either fire-neutral or fire-inhibited (Sugihara et al., 2006). The existing distribution of individuals of a species – endemic, patchy, or continuous – greatly affects how the plant population responds to an individual fire event (McKelvey et al., 1996). Factors such as burn intensity and the spatial pattern of the burn or other treatment affect the plant population response (Sugihara et al., 2006). Generally, prescribed fire is believed to benefit the overall health of fire adapted ecosystems (McKelvey et al., 1996). Prescribed fires generally leave exposed bare mineral soil that is favorable to seedling establishment of fire-stimulated plants. Prescribed fire treatments that do not mimic the natural regime may adversely affect the reproductive capability or viability of a natural community (Sugihara et al., 2006).

However, implementation of prescribed burn treatments could result in an alteration of the natural fire regime. Changes in burning patterns which affect the timing, intensity, frequency, or size of fires on the landscape could potentially have significant adverse effects to plants. Large burns have a greater chance of negatively affecting a plant population than small burns due to the potential of large burns to interrupt seed dispersal mechanisms (Sugihara et al., 2006).

PSR's identified during project development as well as SPR's BIO-8 & BIO-9, as listed and explained at the end of this sub-chapter, are designed to reduce the potential impacts to vegetation to less than significant.

OAK WOODLANDS

Oak woodlands cover approximately 10 million acres in California. About half of this acreage occurs in the foothills of the Sierra Nevada and North Coast/Klamath bioregions. Oak woodlands in California have evolved in a Mediterranean climate where the dry summer seasons create typical fire return intervals of 30-50 years (McCreary, 2004). However, as with other vegetation types in the state, fire suppression activities have interrupted this cycle for most of the 20th century. Prior to fire suppression, frequent low-intensity fires initiated by American Indians or lightning burned through woodlands, killing understory brush and small trees and favoring retention of large diameter overstory trees (McCreary, 2004). Oak woodlands are the most biologically diverse habitat type in California, home to over 300 vertebrate wildlife species (Merenlander and Crawford, 1998).

Blue oak (Quercus douglasii) is California's dominant oak species, representing more than one third of the state's oak woodlands. Live oaks (Q. chrysolepsis, Q. wislizenii, Q. agrifola) comprise another third of California's oak woodlands. However, on California's oak forestlands (as opposed to woodlands and not analyzed in this section) tanoak (Lithocarpus densiflorus), black oak (Q. kelloggii) and canyon live oak (Q. chrysolepsis) account for 80 percent of the hardwoods (Gaman and Firman, 2006).

The most immediate and direct threat to oak woodlands is conversion to other uses. Since 1945 the extent of oak woodlands has decreased by 1.2 million acres (Bolsinger, 1988). Between 1945 and the early 1970's the primary reason for loss of woodlands was conversion to rangelands, but since then commercial and residential development has become the primary source of conversion (Bolsinger, 1988; Spero, 2002). More recently, conversion of oak woodlands to vineyards has also become a major impact (Merenlander and Crawfor,d 1998). An additional 750,000 acres of oak woodlands are at risk of conversion before 2040 (Gaman and Firman, 2006).

A less immediate, but more widespread threat to the majority of oak woodlands, is lack of adequate oak regeneration. Regeneration of coast live oak and blue oak is sparse and nearly non-existent for valley oak (Q. lobata). However, seedlings and saplings are abundant in canyon live oak stands and moderately abundant in interior live oak, black oak and white oak stands (Bolsinger, 1988). Altered fire regimes, grazing pressure from livestock, suppression by woody plants and invasion of European weedy annual grasses are considered to be likely culprits for poor regeneration (CalPIF, 2002; Swiecki et al., 1997).

In the North Coast range of California (Sonoma, Mendocino, Humboldt and Del Norte Counties) invasion of Douglas-fir (Pseudotsuga menziesii) into Northern Oak woodlands presents a threat to the continued dominance of Quercus species in these stands (Barnhart et al., 1996). Encroachment of Douglas-fir into these relatively mesic (wet) oak woodlands is the result of fire suppression since the early 1900's (Barnhart et al., 1996). Prior to fire suppression, frequent low intensity fires killed most Douglas-fir regeneration before it grew large enough to become fire resistant. In the absence of fire or other controls on Douglas-fir regeneration in Northern Oak woodlands it is likely that many of these stands will eventually convert to mixed evergreen forest, rather than oak dominated woodlands.

PSR's identified during project development as well as Implementation of SPR's BIO-6, BIO-8, & BIO-9 as listed and explained at the end of this sub-chapter, are designed to reduce the potential impacts to Oak Woodlands to less than significant.

WILDLIFE

To address potential direct and indirect effects of the VTP on wildlife in an ecologically meaningful way, species have been assigned to four broad guilds (subterranean (soil invertebrates, burrowing mammals, etc.), ground-dwelling (terrestrial invertebrates, reptiles and amphibians, including partially aquatic forms, and mammals), shrub-dwelling (shrub-nesting birds, etc.), and arboreal (arboreal invertebrates, cavity and tree nesting birds and mammals, etc.) based on how they typically use the vertical environment (See Appendix D). Shaffer and Laudenslayer (2006) used similar guilds in addressing effects of fire on animals, but they considered shrub-dwelling species as a subset of arboreal fauna. Since many of the treatments considered here specifically target either scrub habitats or the shrub layer in wooded habitats, we have elevated shrub species to their own guild. We feel such an approach is preferable to addressing broad taxonomic guilds wherein species occupy the full range of available vertical strata because fuel reduction treatments in structurally complex habitats are typically layer-specific. Species are assigned to a single guild based on their primary or most critical (for instance, breeding or over-wintering) use area.

Following PSR's that are identified during project development as well as implementation of SPR's ADM-1, ADM-2, and BIO-1 through BIO-4, as listed and explained at the end of this sub-chapter, are designed to reduce the potential impacts to wildlife to less than significant. These requirements also relate to "habitat of significant value" and "environmentally sensitive habitat areas" as per CEQA and California Coastal Act, respectively.

AQUATIC

Direct impacts to aquatic species that occur within saline and fresh emergent wetlands, lacustrine, riverine, and estuarine habitat types are unlikely because these habitat types are excluded from treatment. Riparian and upland vegetation types adjacent to these excluded vegetation types may be treated and indirect adverse effects to aquatic resources are possible, particularly where multiple VTP projects occur in a single watershed. However, with the implementation SPR's HYD-1 through HYD-14 and HYD-16, as listed and explained at the end of this sub-chapter, as well as PSR's identified during project development, the proposed program is not likely to cross the following thresholds of significance:

- violate any state or federal wildlife protection law regarding aquatic species
- contribute directly (through immediate mortality) or indirectly (through reduced productivity, survivorship, genetic diversity, or environmental carrying capacity) to a substantial, long-term reduction in the viability of any native aquatic species or subspecies at the state level.

Therefore, after mitigations, any significant impacts from implementing the Program or Alternatives are reduced to less-than-significant.

INVASIVE SPECIES

The impacts from non-native invasive species are analyzed by changes in the structure and composition of these populations in relation to vegetation in the dominant natural plant community types. The effects of VTP projects can be analyzed as long as they are distinguishable from presumed changes in the pre-existing plant community composition without any VTP projects. The additive effects of past actions (such as wildfire suppression, timber harvest, mining, nonnative plant introductions, and ranching) have shaped the present landscape and corresponding populations of special status and invasive species.

If the project coordinator determines that there is a significant risk of introducing invasive plants, then project specific mitigation measures will be developed using principles outlined in the California Invasive Plant Council's "Preventing the Spread of Invasive Plants: Best Management Practices for Land Managers (3rd edition)" (2012), or other relevant documents. Implementation of SPR's BIO-8 & BIO-9 as described at the end of this sub chapter as well as PSR's identified during project development and implementation will reduce the potential impact from invasive species resulting from the implementation of projects to less than significant. These include watercourse buffer zones, protection of special status plants & plant populations through CDFW consultation, utilization of an integrated pest management approach, and utilization of only weed free straw and mulch.

DISCUSSION OF ALTERNATIVES

The No Project and Alternatives A-D are considered under this analysis. No Project: Existing Programs Business as Usual, Alternative A: WUI Only, Alternative B: WUI and Fuel Breaks, Alternative C: Projects Limited to Very High Fire Hazard Severity Zones, and Alternative D: Treatments that Minimize Potential Impacts to Air Quality. The No Project alternative would continue to treat approximately 30,000 acres annually, mostly with prescribed fire and without assurances that SPR’s identified in the proposed VTP and alternatives would be implemented. Alternative A proposes to limit fuel reduction projects to WUI areas only, while Alternative B would combine Alternative A with the option to create fuel breaks outside of the WUI. Under Alternative C, vegetation treatment activities would be focused in areas with the highest hazard classification of very high fire hazard severity zones (VHFHSZ). Alternative D would reduce the number of acres treated by prescribed fire and also reduce the average number of acres treated annually to 36,000.

For Alternatives A, B, and C, the scale of the project remains the same as the proposed VTP at 60,000 treated acres per year for ten years, with the same vegetation treatment activities by vegetation type expected to occur. That is, the same amount of acreage would be treated with manual, mechanical, prescribed fire, and herbicide treatments. Geographically, the areas available to be treated by Alternatives A, B, and C are reduced compared to the proposed VTP: Alternatives A and C would have approximately 11.5 million acres available for treatment, while Alternative B would have approximately 16 million acres available for treatment (see Table 3.8-1). Concentrating treatments in a smaller geographic area may increase the impacts to sensitive species and their habitats that exist within the area available for treatment under Alternatives A, B and C. However, with the implementation of HYD-16 projects are not anticipated to be heavily concentrated at the planning watershed level under any of these alternatives. Because the nature of treatment activities are expected to be the same and the scale of the program is similar to that of the VTP, it is expected the overall impacts would be similar to the Proposed VTP for Alternatives A, B, and C.

The No Project Alternative and Alternative D propose to treat fewer acres (27,000 and 36,000 respectively) annually than the proposed VTP. The No Project Alternative would continue the programs CAL FIRE already has in place to treat wildland fuels anywhere in the SRA and establishes the baseline for with the Proposed VTP and all alternatives are measured against. Alternative D proposes to use less prescribed fire (approximately 6,000 acres annually) on an annual basis than the other alternatives. Geographically, the area available for treatment would be the same as the proposed VTP as the treatments would be distributed across the landscape under the same constraints. Projects under Alternative D would be required to implement the same SPR's and mitigation measures as the proposed VTP. Due to the reduction in the number of acres treated with prescribed fire, Alternative D would not be expected to yield the same level of benefit to fire adapted ecosystems that have degraded due to fire exclusion as the other alternatives. All other impacts are expected to be similar in nature to those from the proposed VTP, but should be reduced in scale due to the reduction in the total number of acres treated annually. Because fewer acres are treated under the No Project Alternative and Alternative D, it is expected that the overall impacts to biological resources would be less than the Proposed VTP.

4.2.3 MITIGATION AND STANDARD PROJECT REQUIREMENTS

The results from the bioregional analysis of potential impacts to water quality from VTP projects indicates little overlap with bioregions designated by the State as the "high priority landscape " for water quality (FRAP, 2010). The high priority landscape includes the North Coast/Klamath bioregion, and selected watersheds in the Sierra and South Coast bioregions (FRAP, 2010). Thus, the additional potential risk attributable to VTP projects will not occur in watersheds already deemed by the state to be high quality and at elevated risk of impairment to water quality. Similarly, the FRAP Assessment (2010) identified high and medium priority landscapes for wildlife habitat (including aquatic species) at risk of damage from wildfire; most high and medium priority landscapes occur in the North Coast/Klamath, Sierra, and Modoc bioregions. Again, the bioregions at elevated risk of water quality impairment due to VTP projects do not occur within the high and medium priority landscapes for wildlife (FRAP, 2010). Under this analysis there are no mitigations. However, several Standard Project Requirements have been developed as part of the project design.

4.2.3.1 Standard Project Requirements

Standard project requirements (SPRs) are minimum standards set by the program for individual projects. SPRs apply to all projects governed by the VTP. SPRs are a collection of standard operating procedures, Best Management Practices, and known regulatory requirements related to project impact assessment, implementation, and oversight.

ADM-1: Prior to the start of operations, the project coordinator shall meet with the contractor to discuss all resources that must be protected using standard project requirements (SPRs). If burning operations are done with CAL FIRE personnel, the Battalion Chief and/or their Company Officer designee shall meet with the project coordinator onsite prior to operations to discuss resource protection measures. Additionally, the project coordinator shall specify the resource protection measures and details of the burn plan in the incident action plan (IAP) and shall attend the pre-operation briefing to provide further information.

ADM-2: Prior to the start of operations, and at the discretion of the project coordinator, a registered professional forester (RPF) shall flag and/or fence all protected resources for avoidance during operations. The RPF shall also be required to engage other resource professionals that may address issues beyond the RPF’s experience or expertise, as required by the Professional Foresters Licensing Law (Public Resources Code Sections 752(b)). The project coordinator or designee shall remove the fencing from around the protected resource after project completion.

BIO-1: Projects shall be designed to avoid significant effects and avoid take of rare, threatened, and endangered species, as defined in CEQA Guidelines Section 15380.

BIO-2: The project coordinator shall run a nine-quad search or larger search area (may be required is a project is on the boundary of two USGS quad maps) of the area surrounding the proposed project for rare, threatened, and endangered species, using at a minimum, the California Natural Diversity Database (CNDDB) or its successor.

BIO-3: The project coordinator shall write a summary of all special-status species identified in the biological scoping including the CNDDB search with a preliminary analysis, identifying which species would be affected by the proposed project. A field review will then be conducted by the project coordinator to identify the presence or absence of any special status species, or appropriate habitat for special status species, within the project area.

BIO-4: The project coordinator, shall ensure that a CAL FIRE Environmental Coordinator analyze impacts to CNDDB species, and shall submit the summary and preliminary analysis to the CDFW, USFWS, and [if applicable] NOAA Fisheries for consultation. The preliminary analysis shall be accompanied with a standard letter containing the following:

- A written description of the project location and boundaries
- Brief narrative of the project objectives
- A description of the types of activities used in the project (e.g., prescribed burning; mastication) and associated acreages
- A project and general location map. Project map shall be of sufficient scale to indicate the spatial extent of activities within the project area

- The output from the CNDDB run, including a map of any special status species located during the field review, and the SPRs that will be implemented to minimize impacts on the identified special status species.
- A request for information regarding the presence and absence of rare, threatened, and endangered plant and animal species, including any applicable HCPs, in the project vicinity, and potential take avoidance measures to be implemented as PSRs.
- An offer to schedule a day to visit the project area with the project coordinator.

BIO-5: Vegetation treatment projects that are not deemed necessary to protect critical infrastructure or forest health in San Diego, Imperial, Riverside, Orange, Los Angeles, Ventura, Santa Barbara, Kern, and San Bernardino counties shall:

- Be designed to prevent vegetation type conversion.
- Not take place in vegetation that has not reached the age of median fire return intervals.
- Not re-enter treatment areas for maintenance in an interval shorter than the median fire return interval outside of the wildland urban interface and excluding fuel break maintenance.
- Not take place in old-growth chaparral without consultation regarding the potential for significant impacts with the CDFW and the CNPS.
- Take into account the local aesthetics, wildlife, and recreation of the shrub-dominated subtype during the planning and implementation of the project.
- During the project planning phase provide a public workshop, or public notice in a newspaper that is circulated locally describing the proposed project during the project planning phase for projects outside of the WUI. The notification will be used to inform stakeholders and to solicit information on the potential for significant impacts during the project planning phase.

BIO-6: In shrublands containing native oaks, treatments may incorporate retention of older, acorn producing oaks to create deer forage. CAL FIRE or applicants may plant other vegetation to promote species diversity and improve wildlife habitat, when such practices are not in conflict with program goals.

BIO-7: A minimum 50 foot avoidance buffer shall be established around any special status animal, nest site, or den location; and a minimum 15 foot avoidance buffer shall be established around any special status plant within the project area. Additional buffer distances may be required through consultation with the appropriate State or Federal agencies, or a qualified biologist to avoid significant effects to special status species (see BIO-4).

BIO-8: In order to reduce the spread of new invasive plants, only certified weed-free straw and mulch shall be used.

BIO-9: During the planning phase if the project coordinator determines that there is a significant risk of introducing invasive plants, then project specific mitigation measures shall be developed using principles outlined in the document “Preventing the Spread of Invasive Plants: Best Management Practices for Land Managers (3rd edition” or other relevant documents). Coordination of the mitigations will also include consultation with CDFW.

BIO-10: If water drafting becomes a necessary component of the proposed project, drafting sites shall be planned to avoid adverse effects to special-status aquatic species and associated habitat, in-stream flows, and depletion of pool habitat. Screening devices shall be used for water drafting pumps, and pumps with low entry velocity shall be used to minimize removal of aquatic species, including juvenile fish, amphibian egg masses, and tadpoles, from aquatic habitats.

BIO-11: Aquatic habitats and species shall be protected through the use of watercourse and lake protection zones (WLPZ), as described in California Forest Practice Regulations (14 CCR). Other operational restrictions may be identified through a consultation with CDFW and RWQCB (see BIO-4). See HYD-3 for these standard protection measures.

BIO-12: For projects that require a non-construction-related CDFW Streambed Alteration Agreement, any BMPs identified in the agreement shall be developed and implemented.

BIO-13: If any special status species are identified within the project area, an onsite meeting shall occur between the project coordinator and operating contractor. At this meeting the project manager shall conduct a brief review of life history, field identification, and habitat requirements for each special-status species, their known or probable locations in the vicinity of the treatment site, project specific requirements or avoidance measures, and necessary actions if special-status species or sensitive natural communities are encountered.

HYD-1: The project shall comply with all applicable water quality requirements adopted by the appropriate Regional Water Quality Control Board and approved by the State Water Board (i.e., Basin Plan).

HYD-2: During the planning phase the project coordinator shall submit a standard letter to the appropriate RWQCB containing the following:

- A written description of the project location and boundaries
- Brief narrative of the project objectives
- A description of the types of activities used in the project (e.g., prescribed burning, mastication) and associated acreages

- A project and general location map. Project map shall be of sufficient scale to indicate the spatial extent of activities within the project area
- Notification of whether the project drains directly into an impaired water body, and the type of water quality constituent(s) that is impairing the water body.
- A request for information and recommendations regarding the potential for significant water quality impacts from the proposed project and an offer to schedule a day to visit the project area with the project coordinator. The project shall incorporate the recommendations that prevent significant impacts to water quality as PSRs.

HYD-3: A WLPZ shall be established on each side of all Class I and II watercourses that is equal to the standard widths specified in the current CA Forest Practice Rules (Table 4.2.21). Fifty foot equipment limitation zones (ELZs) shall be established for Class III watercourses. Vegetation within the WLPZ or ELZ will not be disturbed by project activities, with the exception of backing prescribed fire. Class IV watercourse protections shall be PSRs specified in the PSA, and designed in conjunction with any recommendations from RWQCB staff.

Table 4.2-15 Watercourse and lake protection zone buffer widths by watercourse classification and hill slope gradient (See HYD -3)

Note: ELZ-Equipment Limitation Zone, PSR-Project Specific Requirement

Water Class Characteristics or Key Indicator / Beneficial Use	1)Domestic supplies, including springs, on site and/or within 100 feet downstream of the project area and/or 2) Fish always or seasonally present onsite, includes habitat to sustain fish migration and spawning	1) Fish always or seasonally present offsite within 1000 feet downstream and/or 2) Aquatic habitat for non-fish aquatic species. 3) Excludes Class III water that are tributary to Class I waters	No aquatic life present, watercourse showing evidence of being capable of sediment transport to Class I and II water under normal high water flow conditions of timber operations	Man-made watercourses, usually downstream, established domestic, agricultural, hydroelectric supply or other beneficial use
Water Class	Class I	Class II	Class III	Class IV
Slope Class (%)	Width (ft.)	Width (ft.)	Width (ft.)	Width
<30	75	50	50 (ELZ)	PSR
30-50	100	75	50 (ELZ)	PSR
>50	150	100	50 (ELZ)	PSR

HYD-4: No direct ignition shall be allowed within the WLPZ or ELZs. However, it is acceptable for a fire to enter or back into a WLPZ's or ELZ's.

HYD-5: Compacted and/or bare linear treatment areas (e.g., fire breaks, roads, or trails) capable of generating storm runoff shall be drained via water breaks using the spacing guidelines contained in CCR Sections 914.6, 934.6, and 954.6 (c) of the California Forest Practice Rules.

HYD-6: Compacted and/or bare treatment areas shall be drained such that they are hydrologically disconnected from watercourses or lakes. Measures to hydrologically disconnect these areas shall be guided by consulting with Technical Rule Addendum #5 of the California Forest Practice Rules – Guidance on Hydrologic Disconnection, Road Drainage, Minimization of Diversion Potential, and High Risk Crossings

HYD-7: No high ground pressure vehicles shall be driven through project areas when soils are wet and saturated to avoid compaction and/or damage to soil structure. Saturated soil means that soil and/or surface material pore spaces are filled with water to such an extent that runoff is likely to occur. Indicators of saturated soil conditions may include, but are not limited to: (1) areas of ponded water, (2) pumping of fines from the soil or road surfacing material during timber operations, (3) loss of bearing strength resulting in the deflection of soil or road surfaces under a load, such as the creation of wheel ruts, (4) spinning or churning of wheels or tracks that produces a wet slurry, or (5) inadequate traction without blading wet soil or surfacing materials.

HYD-8: When possible, bare soil will be mulched with onsite native vegetative material (e.g., cut material).

HYD-9: During dry, dusty conditions, unpaved roads shall be wetted using water trucks or treated with a non-toxic chemical dust suppressant (e.g., emulsion polymers, organic material). Any dust suppressant product used shall be environmentally benign (i.e., non-toxic to plants and shall not negatively impact water quality) and its use shall not be prohibited by the ARB, U.S. Environmental Protection Agency (EPA), or the State Water Resources Control Board. Exposed areas shall not be over-watered such that water results in runoff. The type of dust suppression method shall be selected by the contractor based on soil, traffic, site-specific conditions, and local air quality regulations.

HYD-10: Prior to the start of onsite activities, all equipment will be inspected for leaks and regularly inspected thereafter until equipment is removed from the project area. All contaminated water, sludge, spill residue, or other hazardous compounds will be contained and disposed of outside the boundaries of the site, at a lawfully permitted or authorized destination.

HYD-11: Staging areas shall be designated and located to prevent leakage of oil, hydraulic fluids, or other chemicals into watercourses or lakes.

HYD-12: All heavy equipment parking, refueling, and service shall be conducted within designated areas outside of the WLPZ or ELZ.

HYD-13: No new roads (including temporary roads) shall be constructed or reconstructed (reconstruction is defined as cutting or filling involving less than50 cubic yards/0.25 linear road miles). Existing roads, skid trails, fire lines, fuel breaks, etc. that require reopening or maintenance shall have drainage facilities applied at the conclusion of the project that are at least equal to those of the California Forest Practice Rules.

HYD-14: Heavy equipment is prohibited on slopes exceeding 65 percent or on slopes greater than 50 percent where the erosion hazard rating is high or extreme. Heavy equipment is prohibited on slopes greater than 50 percent that lead without flattening to watercourses.

HYD-15: Burn piles shall not exceed 10 feet in length, width, or diameter, except when on landings or road surfaces.

HYD-16: At the Calwater Planning Watershed scale, if the combined acreage subjected to mechanical fuel treatments, prescribed fire, and logging exceed 20% of the watershed area within a 10-year timespan, an analysis will be performed to determine the potential for hydrologically-induced significant impacts of the proposed activity.

HYD-17: If herbivory is proposed to treat vegetation in a project area containing watercourses, then the following items must be addressed as PSRs:

- The project will require water on site in the form of an on-site stock pond outside the WLPZ or ELZ, or a portable water source located outside the WLPZ or ELZ.
- The project will specify animal containment measures in the PSA to prevent animals from entering the WLPZ and/or ELZs. These might include the use of fencing (i.e., fixed or portable), the use of guard or herd dogs, or the use of an on-site herder.

4.3 GEOLOGY, HYDROLOGY AND SOILS

Physical processes do not act independently within a watershed. In recognition of this, we use a hydrogeomorphic framework for describing the baseline conditions of the affected area and for assessing the impacts of the Program and the alternatives. Hydrogeomorphology is the “the interaction and linkage of hydrologic processes with landforms or earth materials and the interaction of geomorphic processes with surface and subsurface water in temporal and spatial dimensions" (Sidle and Onda, 2004). Given this definition, a hydrogeomorphic framework is appropriate for analyzing impacts to geologic, hydrologic, and soil resources.

Examples of linked hydrogeomorphic processes include changes in the magnitude and frequency of stream discharge which can drive changes in sediment transport, or increased pore water pressures which can decrease the forces that resist landsliding. Project-induced hydrogeomorphic process alterations have the potential to significantly impact the beneficial uses of water and/or other resources of concern (Figure 4.3-1). Acknowledging the linkages between physical processes and the resource(s) of concern provides a more effective approach for impact assessment than compared to dealing with each impact in isolation. In turn, this analysis provides a basis for the aquatics and water quality impacts analysis in Sections 4.2 and 4.5, respectively.

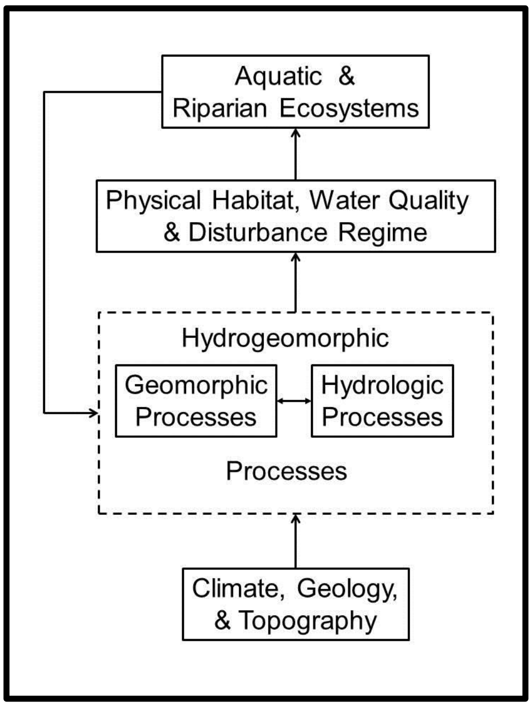


Figure 4.3-4.3-1 A schematic illustration of the linkages between hydrogeomorphic processes and aquatic/riparian ecosystem response. At regional scales, these process and functional linkages are controlled by climate, geology, and topography (adapted from Montgomery, 1999).

The material presented in Section 4.3 has been broken into three components:

- **4.3.1 Affected Environment**
  - The Affected Environment section discusses the regulatory framework that limits impacts to geologic, hydrologic and soil resources, as well as the baseline hydrogeomorphic setting in which the Program occurs, and special concerns present in each geomorphic province.
- **4.3.2 Effects**

    - The Effect section outlines the potential impacts of implementing the proposed Program and the alternatives.
- **4.3.3 Mitigations**
    - The Mitigation section provide the standard program requirements to reduce the likelihood of the proposed Program in causing adverse impacts to geologic, hydrologic, and soil resources.

4.3.1 AFFECTED ENVIRONMENT

The following section summarizes the baseline regulatory setting and environmental conditions for geology, hydrology, and soils for the areas potentially affected by the Program.

4.3.1.1 Regulatory Setting

The proposed Program is subject to a number of geologic, hydrologic, and soil-related requirements associated with federal and state regulations.

CLEAN WATER ACT (33 U.S.C. SECTION 1251 ET SEQ.)

The Clean Water Act (CWA) is a 1977 amendment to the Federal Water Pollution Control Act of 1972. The CWA provides standard regulations for the discharge of pollutants to the waters of the United States (U.S.) in order to maintain their chemical, physical, and biological integrity and protect their beneficial uses. In addition, the CWA provides the statutory basis for the National Pollutant Discharge Elimination System (NPDES). Waters of the U.S. are defined as coastal waters, territorial seas, bays, rivers, streams, lakes, ponds, and wetlands (Code of Federal Regulations 40 CFR 122.2).

The CWA requires states to adopt water quality standards that must be approved by the U.S. Environmental Protection Agency (EPA) and requires NPDES permits for the discharge of pollutants in U.S. waters. In addition, the CWA gives authority to the EPA to (1) implement pollution control programs, including setting waste water standards and effluent limits on an industry-wide basis; and (2) authorize the NPDES Permit Program permitting, administration, and enforcement to state governments with oversight by the EPA.

Under Section 303(d) of the CWA, states (states, territories, and tribes) are required to develop lists of impaired and threatened waters. Impaired waters (e.g., rivers, streams, and lakes) are defined as those that do not meet water quality objectives because required pollution control mitigations are not sufficient to attain or maintain these standards. A 303(d) listing acts a “trigger” for states to monitor these water-bodies and develop Total Maximum Daily Loads (TMDL) for each pollutant. The TMDL is a calculation of the maximum allowable amount of a pollutant impaired waters can receive without significant negative environmental effects, violation of water quality standards, and/or harm to beneficial uses. The TMDL process also provides an analysis of the linkages between pollutant reductions and the attainment of water quality objectives. The TMDL may also function as an action plan that provides management priorities and mitigation strategies for addressing water quality impairments. The EPA must approve a state's TMDL or, if denied, the EPA will prepare and implement its own.

Sections under "Title IV-Permits and Licenses" of the Clean Water Act regulate the permits and licenses required for any activity that could impair surface waters.

- Section 401, enforced by the SWRCB and RWQCBs, require the discharger to obtain certification from the state that potential discharges will comply with approved effluent limits and water quality standards.
- Section 402 regulates the point- and non-point source discharges to surface waters through the NPDES permit program. The NPDES permit program is overseen by the SWRCB and administered by each RWQCB. A general (covers multiple facilities within a specific category) or individual NPDES permit is required for any municipal or industrial point-source discharge and nonpoint-source storm water discharge. NPDES permits set limits on allowable pollutant emissions or effluent discharges, prohibit the discharges not specifically allowed by the NPDES permit and provide the discharger with required mitigations to monitor and reduce potential point- and nonpoint-source pollutant discharges. NPDES permits issued for listed pollutants must be consistent with TMDL load allocations.
- Section 404, regulated by the U.S. Army Corps of Engineers (USACE), requires a permit prior to any activity that involves the discharge of dredged or fill material into waters of the U.S. at designated approved locations. Projects with impacts less than or equal to 0.5 acres may be approved through the Nationwide Permit Program (NWP).

Phase I and Phase II of the EPA storm water program were promulgated under the CWA in order to further protect water quality, aquatic habitat, and beneficial uses from storm water runoff. The EPA storm water program requires that projects involving more than one acre of ground disturbance develop and obtain approval of a Storm Water Pollution Prevention Plan (SWPPP) prior to construction activities, and the implementation of best management practices (BMPs) to control runoff from construction sites during and after construction operations. A Notice of Intent (NOI) must be submitted to the SWRCB when a project is subject to a NPDES permit. Construction projects involving less than one acre of ground disturbance are exempt from these regulations.

SECTIONS 9 AND 10 OF THE RIVERS AND HARBORS ACT (33 U.S.C. 401 ET SEQ.)

Sections 9 and 10 of the Rivers and Harbors Act (33 U.S.C. 301 et seq.) are regulated by the USACE and require a permit for the construction of any structure within or over “navigable water”: excavation, dredging, or deposition of material in or any obstruction or alteration of “navigable waters.” Navigable waters include coastal and inland waters, lakes, rivers, and streams that are wide and deep enough to provide passage; territorial seas; and wetlands adjacent to aforementioned navigable waters. A Section 10 Permit is also required in un-navigable waters, if the activity will have an influence on the course, location, condition, or capacity of the navigable water body.

FEDERAL ANTIDEGRADATION POLICY (CODE OF FEDERAL REGULATIONS - TITLE 40: PROTECTION OF ENVIRONMENT 40CFR 131.12)

The Federal Antidegradation Policy was issued in 1968 by the U.S. Department of the Interior to (1) ensure that activities will not lower the water quality of existing use, and (2) restore and maintain “high quality water.” The federal policy maintains that states shall adopt a statewide antidegradation policy that includes the following conditions:

- Existing instream water uses and a level of water quality necessary to maintain those uses shall be maintained and protected.
- Water quality will be maintained and protected in waters that exceed water quality levels necessary for supporting fish, wildlife, and recreational activities, and water quality, unless the State deems that water quality levels can be lowered to accommodate important economic or social development. In these cases, water quality levels can only be lowered to levels that support all existing uses.
- Where high quality waters constitute an outstanding National resource, such as waters of National and State parks and wildlife refuges and waters of exceptional recreational or ecological significance, that water quality shall be maintained and protected.

PORTER-COLOGNE WATER QUALITY ACT (CAL. WATER CODE DIV. 7)

The Porter-Cologne Water Quality Act is a key element of California water quality control legislation. Under the act, the SWRCB is given authority over state water rights and water quality policy and it established the State’s nine RWQCBs to regulate and oversee regional and local water quality issues. The RWQCB is also responsible for developing and updating Basin Plans targeted toward (1) protecting waters designated with beneficial uses, (2) establishing water quality objectives for surface water and groundwater, and (3) determining actions necessary to maintain water quality standards and control point- and nonpoint-sources of pollution into the State's waters. Under the Act, proposed waste dischargers are required to file Reports of Waste Discharge (RWDs) to the RWQCB and the SWRCB and RWQCB are granted jurisdiction over the issuance and enforcement of Waste Discharge Requirements (WDRs), NPDES permits, and Section 401 water quality certifications.

CALIFORNIA STATE ANTIDEGRADATION POLICY (SWRCB RESOLUTION NO. 68-16, "POLICY WITH RESPECT TO MAINTAINING HIGHER QUALITY WATERS IN CALIFORNIA")

In 1968, the State of California adopted an antidegradation policy in response to directives under the Federal Antidegradation Policy. The antidegradation policy applies to high quality waters of the State, including surface waters and groundwater, and all existing and potential uses. The policy requires that high quality waters be maintained to the maximum extent possible and any proposed activities that can adversely affect high quality surface water and groundwater must (1) be consistent with the maximum benefit to the people of the State, (2) not unreasonably affect present and anticipated beneficial use of the water, and (3) not result in water quality less than that prescribed in water quality plans and policies.

CALIFORNIA DEPARTMENT OF FISH AND GAME CODE SECTIONS 1600–1603 (STREAMBED ALTERATION)

The California Department of Fish and Wildlife (CDFW) is responsible for conserving, protecting, and managing California's fish, wildlife, and native plant resources. The CDFW Lake and Streambed Alteration Program (Fish and Games Codes 1600-1603) states that it is unlawful to substantially divert or obstruct the natural flow of any river, stream or lake, or substantially change or use any material from the bed, channel, or bank of, any river, stream, or lake, or deposit or dispose of debris, waste, or other material containing crumbled, flaked, or ground pavement where it could pass into any river, stream, or lake as designated by CDFW. Any proposed activity that violates the aforementioned rule must obtain a Lake or Streambed Alteration Agreement. The Lake or Streambed Alteration Agreement notifies CDFW of the proposed activity and provides proof that the activity will not substantially adversely affect existing fisheries and wildlife, and mitigation measures or BMPs will be employed to protect fish and wildlife resources. The Lake or Streambed Alteration Agreement is required for any work conducted within the 100-year floodplain of a stream or river and adjacent riparian areas.

OTHER FEDERAL AND STATE REGULATIONS

Other federal and state regulations pertaining to geologic, hydrologic, and/or soil resources, but not affected by the Program include:

- National Earthquake Hazards Reduction Act (U.S. Code Title 42 Section 7704);
- Alquist Priolo Earthquake Fault Zoning Act (Public Resources Code Section 2621-2630);
- Seismic Hazards Mapping Act (Public Resources Code, Chapter 7.8, Section 2690-2699.6); and
- Surface Mining and Reclamation Act of 1975 (Public Resources Code Section 2710).

4.3.1.2 **Environmental Setting**

The following subsections use geomorphic provinces as stratification for characterizing baseline geologic, hydrologic, and soils conditions (i.e., hydrogeomorphic conditions) at the state-wide scale.

4.3.1.2.1 Geomorphic Provinces

At very broad scales, climate, geology, and topography determine overall runoff characteristics, earth material properties, and slope (Montgomery, 1999). Climate drives temperature and precipitation, which can influence geologic weathering and the type, timing, and magnitude of hillslope and fluvial runoff. Geology controls material strength and lithology (rock type), which directly affects the hydrologic properties (i.e., infiltration capacity, hydraulic conductivity) of soils due to the parent material's differing proportion of sand, silt, and clay (Montgomery and Bolton, 2003). Topography has an important influence on hydrogeomorphic processes due to its effect on slope, which controls the hydraulic gradient of water flow, as well as the driving forces for landsliding (Montgomery, 1999).

Geomorphic provinces are spatial units that distinguish between variations in tectonic setting, topography, rock type, geological structure, climate, and climate history (Montgomery, 1999). This hierarchical perspective helps to focus broad scale impact assessment of proposed projects on hydrogeomorphic processes and the resources of concern that are influenced by these processes (Frissell et al., 1986). This assessment utilizes the geomorphic province as the principle stratification when assessing impacts to geomorphic and hydrologic processes. Figure 4.3-2 shows the recognized geomorphic provinces for California and Table 4.4-1 provides a general description for each province. Table 4.4-1 also provides a relative characterization for province scale tectonic setting, rock/soil strength, topographic relief, and precipitation. These variables will be described in more detail further in this subsection.

BASIN AND RANGE

The Basin and Range province is a large region of alternating north-south trending faulted mountains and valley floors that encompasses the majority of the western U.S, including portions of southern Oregon, eastern California, southern portions of Arizona and New Mexico, western Texas, and the majority of Nevada. The province is characterized by rugged desert country with high topographic relief. Within California, the lowest point is 282 feet below sea level in Death Valley and the highest elevation is 14,242 feet above sea level at White Mountain Peak (Sharp, 1994). California's portion of the Basin and Range province includes three separate physiographic areas. The northernmost portion of the province is bounded by the Modoc Plateau province and the Nevada border. The middle portion of the province is bounded to the north by the Modoc Plateau province and to the south by the Sierra Nevada province. The largest and southernmost portion of the province is bounded on the west by the Sierra Nevada province, to the south by the Mojave Desert province, and to the east by the Nevada border. The Basin and Range province is cut off abruptly by the Garlock fault to the south. The mountain ranges and intervening valleys are 50 to 100 miles long and 15 to 20 miles wide (Sharp, 1994).

CASCADE RANGE

The Cascade Range is a mountainous region stretching from British Columbia, Canada, down to northern California. The Cascade Range is part of the Pacific Ring of Fire, a nearly continuous arc of intense seismicity and volcanoes around the Pacific Ocean. All of the known historic eruptions in the contiguous United States have originated from Cascade Range volcanoes (Sutch and Dirth, 2003). The last Cascade Range volcano to erupt in California was Lassen Peak, which erupted from 1914 to 1921. Lassen Peak is the most southerly active volcano in the Cascade Range volcanic chain.

The California portion of the Cascade Range province is located between the Klamath Mountains province to the west and the Modoc Plateau province to the east, and extends south from the Oregon border to the Great Valley and Sierra Nevada provinces (Sutch and Dirth, 2003). The northern part of the Cascade Range in California is divided into the Western Cascade Range and the High Cascade Range. The Western Cascades are composed of eroded Oligocene to Pliocene volcanic and volcaniclastic rocks overlying older Upper Cretaceous and Eocene sedimentary rocks. Volcanic rocks of the Western Cascade series were faulted and tilted eastward and northeastward in the Late Miocene (MacDonald, 1966).

Erosion destroyed the steep volcanic landforms of the Western Cascade Range and reduced the region to gentle rolling hills before renewed volcanism built the High Cascade Range. Southward the volcanic rocks of the Western Cascade Range are overlapped by those of the High Cascade Range. The High Cascade Range within California consists largely of pyroxene andesite and is characterized by a long ridge of eroded topography with few, if any, large volcanic cones (MacDonald, 1966).

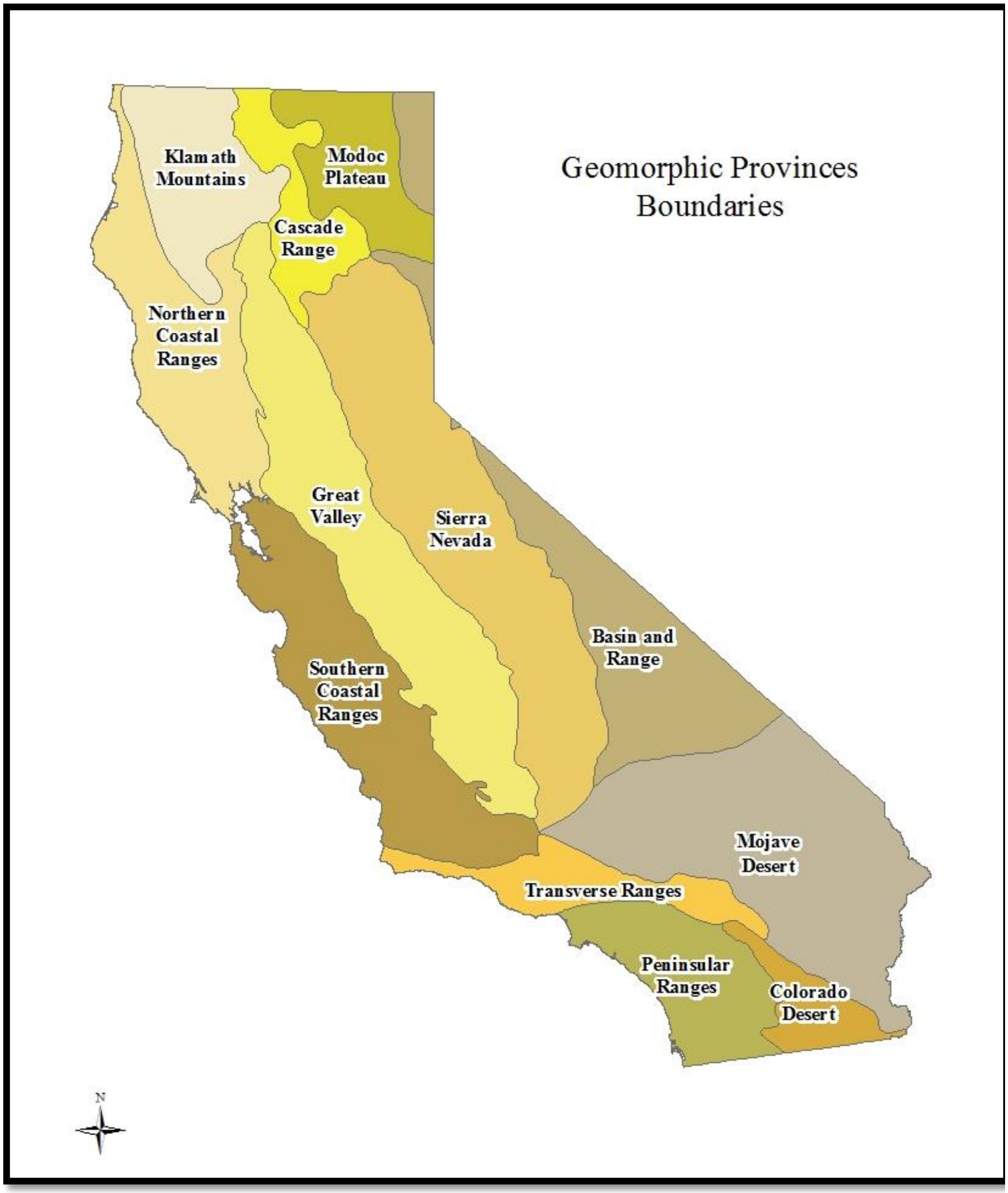


Figure 4.3-2 The geomorphic provinces of California (CGS, 2002).

COAST RANGES

The Coast Ranges province extends 400 miles along the Pacific Coast from the Oregon Border south to the Santa Ynez Mountains at the Transverse Ranges boundary. The evolution of the Coast Ranges is a result of typical tectonic, sedimentary, and igneous processes of the circum-Pacific orogenic belt (Page, 1966). The province can be further divided into northern and southern ranges separated by the San Francisco Bay. The San Francisco Bay is located in a structural depression created by the east-west expansion of the San Andreas and Hayward fault systems.

The California Coast Ranges are primarily composed of Jurassic- to Cretaceous-age (about 65-150 million years old) marine sedimentary and volcanic rocks of the Franciscan assemblage. The Franciscan assemblage consists of partially metamorphosed greenstone, basalt, chert, and graywacke that originated as sea floor sediments. The coastline along this province is uplifted, wave-cut, and terraced. The eastern border of the Coast Ranges province is characterized by strike-ridges and valleys in Mesozoic strata (CGS, 2002).

COLORADO DESERT

The Colorado Desert province is located to the east of the Peninsular Ranges province and west of the Mojave Desert province. Part of the boundary on the north is formed by the eastern Transverse Ranges. The eastern boundary runs along the Little San Bernardino, Orocopia, and Chocolate Mountains. The Colorado River runs through the extreme southeast corner of the province. Elevations throughout the province are low and extend below sea level in the valley bottoms. The Salton Trough, a northwest trending basin located completely within the province, is the largest area below sea level in the Western Hemisphere. The trough is a pull-apart structure where crustal spreading is taking place. The Salton Sea, the largest lake in California, is located within the Salton trough and receives drainage from the Coachella Valley to the north and the Imperial Valley to the south. The crust beneath the Salton Sea is 12 to 15 miles thick, about six miles thinner than continental crust in other areas, and is seismically active (Sutch and Dirth, 2003). The Salton Trough was filled intermittently with the large ancient Cahuilla Lake during the Pleistocene. Fossil shorelines are well defined at the base of the Santa Rosa Mountains.

GREAT VALLEY

The Great Valley of California, also called the Central Valley of California or the San Joaquin-Sacramento Valley, is a nearly flat alluvial plain extending from the Tehachapi Mountains on the south to the Klamath Mountains to the north, and from the Sierra Nevada to the east to the Coast Ranges to the west. Elevations of the alluvial plain are nearly 300 feet above sea level, with extremes ranging from a few feet below sea level to about 1,000 feet above sea level. The only prominent topographic feature within the central part of the valley is the Marysville (Sutter) buttes, a Pliocene volcanic plug that abruptly rises 2,000 feet above the surrounding valley floor.

Geologically, the Great Valley is a large elongate northwest-trending asymmetric structural trough that has been filled with tremendously thick sequences of sediments ranging in age from Jurassic to Recent and has a long stable eastern shelf supported by the subsurface continuation of the granitic Sierran slope and the short western flank expressed by the upturned edges of the basin sediments. The basin has a regional southward tilt and is cut by two significant cross-valley faults. The northernmost fault, the Stockton fault, is the boundary used by most geologists to separate the Great Valley Basin into the Sacramento and San Joaquin River basins. The other great cross-fault lies near the southern end of the basin and is named the White Wolf fault.

KLAMATH MOUNTAINS

The Klamath Mountains cover an elongated north-trending area within northern California and southern Oregon. In California, it includes many different mountain ranges including the South Fork, Salmon, Scott, Scott Bar, and Marble Mountains, the Trinity Alps, and the southern portion of the Siskiyou Mountains (Irwin, 1966). Accordant summit levels, highly dissected old land surfaces, and high elevation glacial topography are striking features of many of the ranges within the Klamath Mountains province. The slopes of most of the ranges are heavily forested with fir and pine, particularly in the western portion of the province. The thick forest cover is largely due to heavy rainfall during the winter months (Irwin 1966). Most of the rainfall drains westerly through deeply incised canyons of the Klamath and Trinity Rivers. The easternmost areas of the province drain towards the east and then south to the Sacramento River (Irwin 1966).

The principle rocks of the Klamath Mountains were deposited and concreted during the Nevadan Orogeny (Late Jurassic). The rocks range from Ordovician to Late Jurassic in age and consist largely of greywacke sandstones, mudstones, greenstones, radiolarian cherts, limestone, and igneous intrusive rocks (Irwin, 1966). Their pattern of distribution is one of concentric arcuate belts that from east to west are referred to as the Eastern Klamath, Central Metamorphic, and Western Paleozoic and Triassic, and Western Jurassic belts.

MODOC PLATEAU

The Modoc Plateau consists of a series of northwest to north-trending block-faulted ranges, with intervening basins filled with broad-spreading "plateau" basalt flows, or with small shield volcanoes, steeper sided lava or composite cones, cinder cones, and lake deposits resulting from disruption of the drainage by faulting or volcanism (MacDonald, 1966). The Modoc Plateau contains an expanse of lava flows at an altitude of 4,000 to 6,000 feet and is considered a part of the western extent of the Great Basin that was flooded by volcanics related to the Cascade Range volcanics (MacDonald, 1966). The province is bounded on the west by the Cascade Ranges province, to the east and south by the Basin and Range province, and to the north by the Oregon border.

MOJAVE DESERT

The Mojave Desert Province is a broad interior region isolated by mountain ranges separated by expanses of desert plain (CGS, 2002). Valley bottoms range in elevation from 2,000-4,000 above sea level and mountains range between 3,500 and 5,000 feet. The highest elevation in the province is 7,929 feet at Clark Mountain (Sutch and Dirth, 2003). The province is situated in the southeastern corner of California and bordered by the Basin and Range province and the Sierra Nevada province to the north, and the Transverse Ranges province and the Colorado Desert provinces to the southwest (Sutch and Dirth 2003). In relation to tectonics, the Mojave Desert is bordered by the Garlock fault to the north, the San Andreas Fault to the southwest, and the southern extension of the Death Valley fault zone to the east (Walker et al. 2002). Rocks of Precambrian to late Cenozoic age are exposed across the greater Mojave Desert Province region. The area forms the southeastern extent of the Precambrian continental North America (Martin and Walker, 1992).

PENINSULAR RANGES

The Peninsular Ranges province consists of southeast-northwest trending ranges separated by long valleys that run sub-parallel to faults branching from the San Andreas Fault. The Peninsular Ranges merge northward into the Los Angeles Basin, where their northwest trend eventually terminates against the east-west trending Transverse Ranges Province. The Peninsular Ranges province is bounded by the Transverse Ranges province to the north, the Colorado Desert province to the east, and the Mexico border to the south. Westward, the province does not end at the Pacific shore, but continues far out under the ocean as a broad submerged continental borderland.

SIERRA NEVADA

The Sierra Nevada is a strongly asymmetric mountain range with a long gentle western slope, and a high and steep eastern escarpment. It is 50 to 80 miles wide and runs northward through eastern California for more than 400 miles, from the Mojave Desert in the south to the Cascade Range in the north. The topography of the Sierra Nevada is shaped by uplift and glacial action. The Sierra Nevada is a huge block of the earth’s crust that has broken free on the east along the Sierra Nevada fault system and been tilted westward. It is overlapped on the west by sedimentary rocks of the Great Valley and on the north by volcanic sheets extending south from the Cascade Range. A blanket of volcanic material caps large areas in the northern part of the range.

Most of the south half of the Sierra Nevada and the eastern part of the northern half are composed of plutonic (chiefly granitic) rocks of the Mesozoic age. These rocks compose the Sierra Nevada batholith, a part of an early continuous belt of plutonic rocks that extend from Baja California northward through the Peninsular Ranges and the Mojave Desert. It extends east through the Sierra Nevada at an arcuate angle to the long axis of the range and to the west into Nevada.

TRANSVERSE RANGES

The Transverse Ranges province averages 30 miles long and is nearly 300 miles wide, extending from Point Arguello eastward to the Eagle Mountains in the Colorado Desert (Sharp, 1994). Mountains in the Transverse Ranges province are composed of progressively older rocks from the west to the east (Sutch and Dirth, 2003). The east-west trending landscape defines the Transverse Ranges province, so named because structurally, the geologic features of this province are crosswise to the usual north-westerly trend of California topography. This characteristic is established by faults and folds that control the trend and shape of the mountains, valleys and coastline. Sedimentary rocks predominate in the west and older igneous and metamorphic rocks predominate in the east (Sharp, 1994). One of the largest pre-historic landslides in the nation, the Blackhawk landslide, is found within this province. This landslide is located on the north side of the San Bernardino Mountains and is five miles long and two miles wide and up to 100 feet thick. The volume of the landslide is estimated to be 370 million cubic yards in size (Sutch and Dirth, 2003).

TECTONIC SETTING

Tectonics refers to the large scale processes that move and deform the earth's crust. Tectonics are most relevant to hydrogeomorphic processes through the mechanisms of relief production and the weakening of earth materials through fracturing (Molnar et al., 2007). Relief production increases the potential energy of erosive agents, whereas rock fracturing decreases the size of earth material thereby making it more susceptible to transport. Table 4.3-1 characterizes the tectonic setting for the various geomorphic provinces. A designation of "low" indicates that tectonic activity is relatively quiescent, whereas "high" indicates that tectonic activity has resulted in seismic activity, relatively high relief, and/or large scale weakening of earth materials.

The lowest tectonic activity is associated with the Great Valley and Modoc Plateau geomorphic provinces. The tectonic setting of the Great Valley is one of a forearc basin situated between the Sierran arc and the Mesozoic subduction zone, whereas the Modoc Plateau has been subject to crustal extension (Harden, 2004). The Sierra Nevada and Klamath Mountains display moderate tectonic activity. The Sierra Nevada is the recently uplifted remains of an ancient volcanic arc formed by Mesozoic subduction and accretion. The Klamath Mountains province is a result of Mesozoic subduction, accretion, and intrusion of granitic plutons (Harden, 2004).

Moderate to high levels of tectonic activity are present in the Transverse Ranges, Basin and Range, Peninsular Ranges, and Coast Ranges. The Transverse Ranges are presently subjected to transform plate motion and strike-slip shearing. The left-stepping bend in the San Andreas Fault has resulted in compressional forces causing some of the highest rates of uplift in the world (Harden, 2004). The Basin and Range province has been subjected to crustal extension for the past 22 million years (Harden, 2004) and has been subject to strong earthquakes. The Peninsular Ranges are currently subject to transform faulting and are also subject to uplift (Harden, 2004). The Coast Ranges have a complex tectonic history of Mesozoic subduction and accretion, as well as Cenozoic transform plate motion associated with the San Andreas Fault.

Some of highest levels of tectonic activity are associated with crustal extension in the Colorado Desert geomorphic province. This tectonic activity has resulted in features such as the Salton Trough, a pull-apart sedimentary basin that has also experienced relatively recent volcanism. The Mojave Desert province is bounded on the west by the San Andreas Fault and the north by the Garlock Fault, and has also been subjected to crustal extension and recent volcanism. The Cascade Range province is associated with active subduction along the Cascadia subduction zone. Active subduction has resulted in volcanic cone formation, with the elevation of Mount Shasta exceeding 14,000 feet. High levels of tectonic activity are also associated with portions of the Coast Ranges proximal to the Mendocino Triple Junction. This portion of the Coast Ranges has been subjected to extensive deformation, crustal thickening, and relief production (Furlong and Govers, 1999).

ROCK/SOIL STRENGTH

Rock and soil strength refers to the ability of the earth material to resist deformation by compressive, tensile, or shear stresses, the ability of the material to resist abrasion, or the resistance of the material to be transported in a fluid (Selby, 1982). Weaker materials will generally be more susceptible to significant impacts (i.e., erosion, mass wasting, etc.) from land use activities than stronger materials. In Table 4.3-1, a designation of "low" means that the rock/soil material has relatively high erodibility, whereas a designation of "high" indicates that the earth material has a high resistance to erosion processes.

The weakest materials are shale, claystone, pre-existing landslides, and unconsolidated sedimentary units. Intermediate rock strength values are assigned to materials such as weakly cemented sandstones. The highest material strength is assigned to crystalline rock (e.g., granitic rocks) and strongly cemented sandstones. Figure 4.3-3 shows that the largest areas of weak earth materials are in the sedimentary basins of the Great Valley, Mojave Desert, and Colorado Desert geomorphic provinces. However, slopes in these areas are generally gentle or flat. Areas of low rock strength are also common in the Transverse Ranges and Coast Ranges geomorphic provinces. Intermediate rock/soil strength is common in the Cascade Range, Modoc Plateau, and Northern Coastal Ranges geomorphic provinces. The highest strength values for earth materials are in the Klamath Mountains and Sierra Nevada geomorphic provinces, although some high strength rock units are also found in the Transverse Ranges, Peninsular Ranges, and in portions of the Coast Ranges geomorphic provinces.

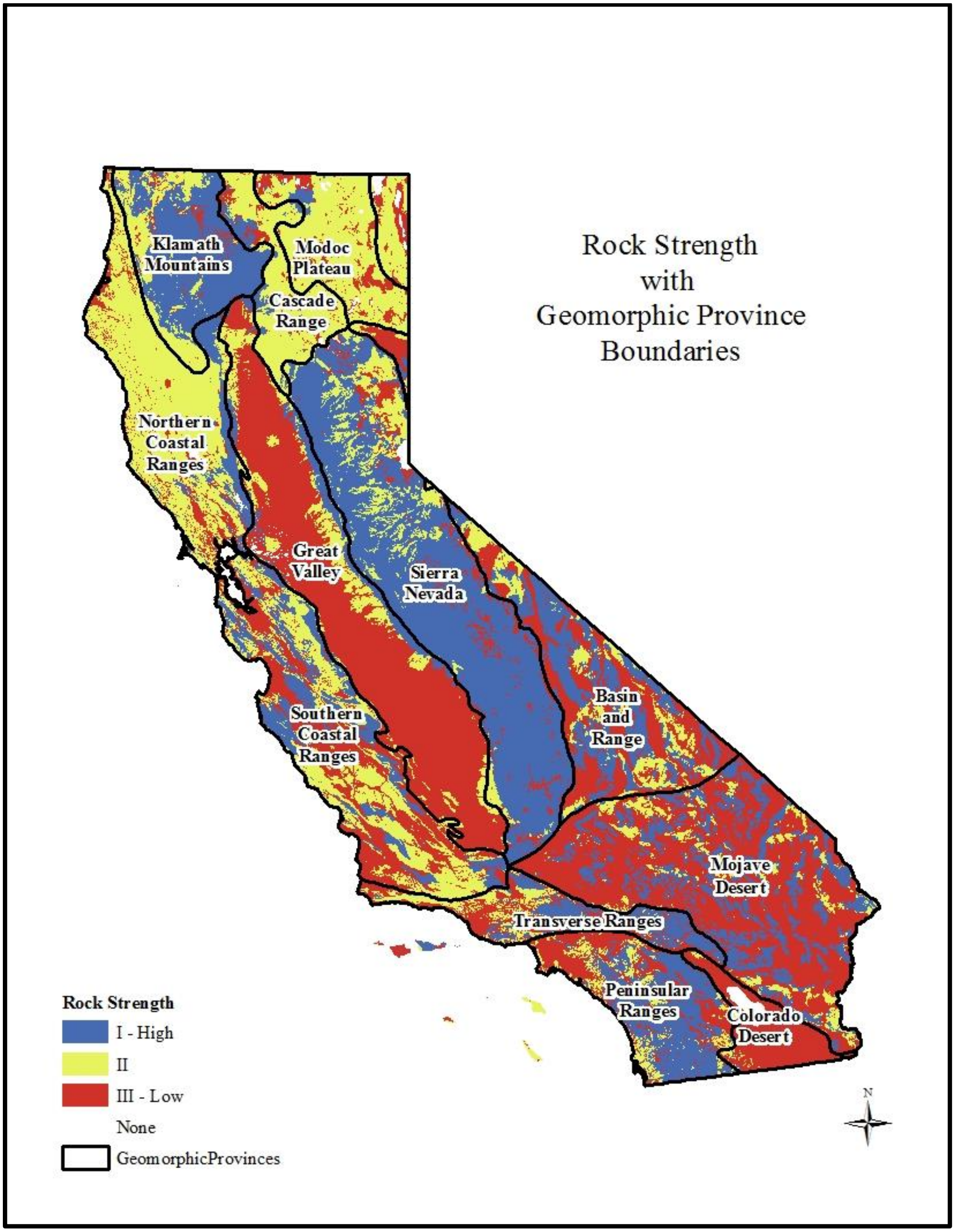


Figure 4.3-4.3-3 Relative rock strength by geomorphic province. Category I (blue) represents the highest rock strength, Category II (yellow) represents moderate rock strength, and Category III represents low rock strength (CGS, 2011). Lower rock strengths typically represent less resistance to erosion processes.

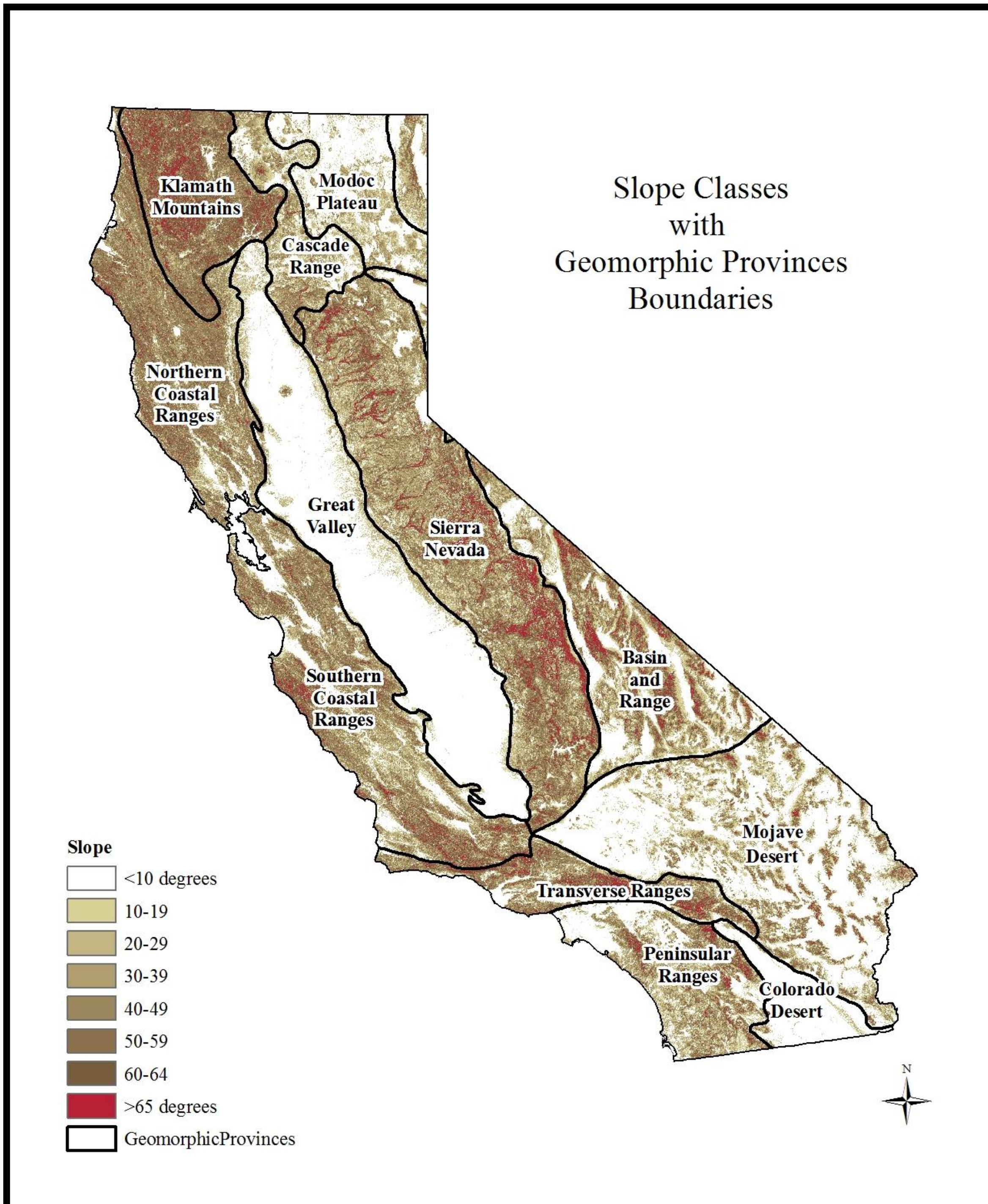


Figure 4.3-4 Slope percentage class by geomorphic province. The steepest slopes are in the Klamath Mountains, Coast Ranges, Sierra Nevada, and Transverse Ranges. Slopes over 65% are more susceptible to shallow landsliding (CGS, 2013).

TOPOGRAPHIC RELIEF

Topography has an important influence on hydrogeomorphic processes due to its effect on slope, which controls the hydraulic gradient of water flow, the energy of erosive runoff, as well as the driving forces for landsliding (Montgomery, 1999). Topography is strongly controlled by an area’s tectonic setting (Wobus et al., 2006). In Table 4.3-1, a designation of “low” means that the geomorphic province has relatively gentle slopes, and a province with a characterization of “high” has relatively steep slopes.

Geomorphic provinces with low topographic relief include the Colorado Desert and the Great Valley provinces. Low to moderate topographic relief exists for the Modoc Plateau and the Mojave Desert geomorphic provinces. Low to high relief is a characteristic of the Basin and Range province, whereas the Coast Ranges province displays moderate to high topographic relief. The highest topographic relief occurs in the Klamath Mountains, Sierra Nevada, and Cascade Ranges geomorphic provinces, where maximum elevations exceed 9,000 to 14,000 feet.

PRECIPITATION

Precipitation is a driving input that influences weathering, soil moisture, hillslope runoff, and hydrology. In general, areas with higher magnitudes of precipitation will have a higher susceptibility to impacts from land use activities. Precipitation can have a paradoxical effect on erosion due to its influence on vegetative cover. Areas with higher precipitation can have lower erosion rates due to the shielding cover of vegetation. However, in the absence of vegetative cover, higher precipitation magnitudes generally will result in higher erosion rates. As such, geomorphic provinces designated as “high” (Table 4.3-1) will have the highest precipitation magnitudes, and potentially the most significant erosion processes.

The lowest annual precipitation occurs in the Mojave Desert, Colorado Desert Basin and Range, and Great Valley geomorphic provinces. Both the Basin and Range and Great Valley provinces show a progressive increase in precipitation magnitude in a northward direction. The Modoc Plateau and Peninsular Ranges shows a low to moderate annual precipitation magnitude, whereas the Transverse Ranges and southern portion of the Coast Ranges show a moderate amount of annual precipitation. The highest amount of precipitation is associated with the crests of the Northern Coast Ranges, Cascade Ranges, Klamath Mountains, and Sierra Nevada geomorphic provinces.

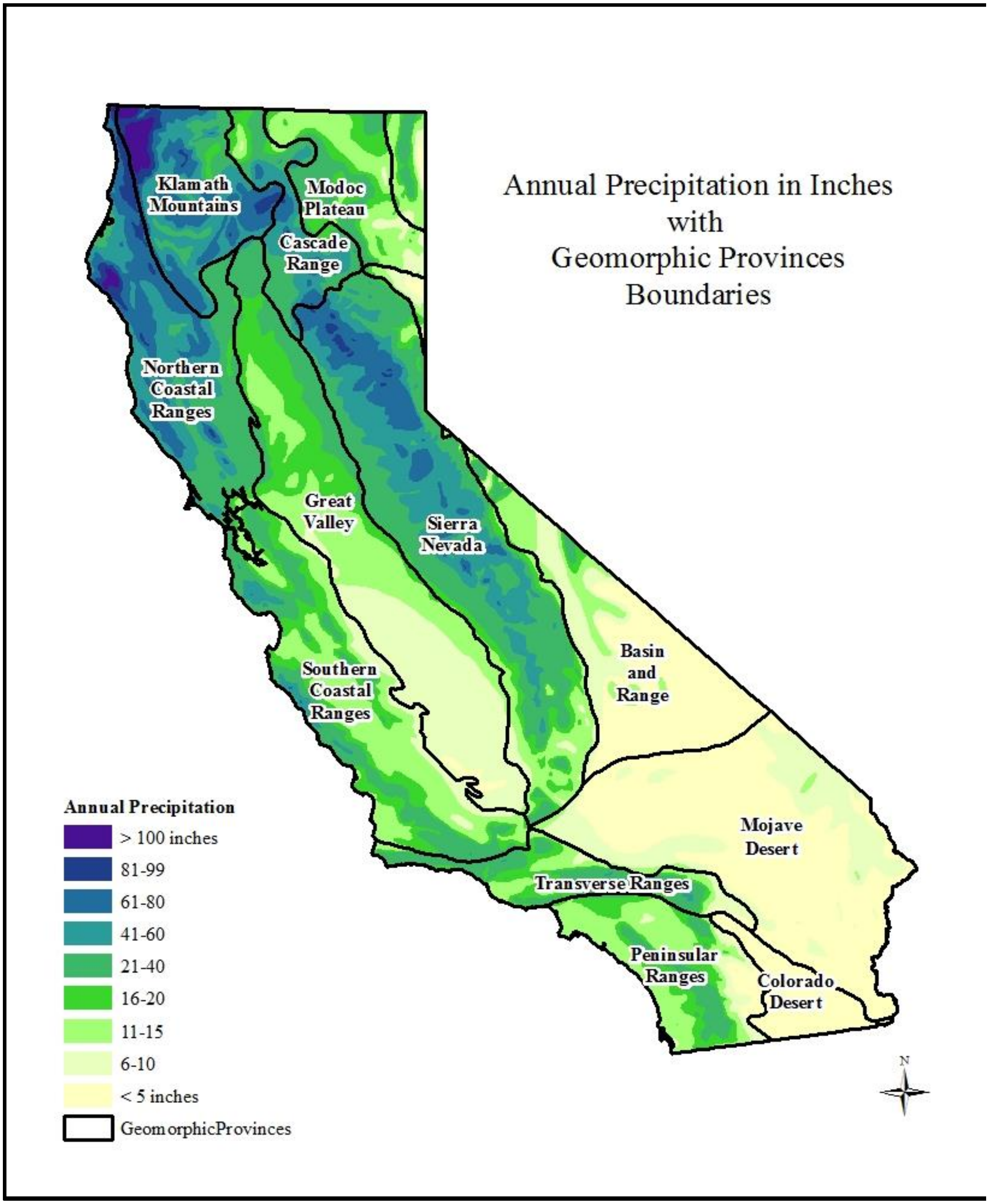


Figure 4.3-5 Annual precipitation by geomorphic province. The Northern Coast Ranges, Klamath Mountains, Cascade Range, and Sierra Nevada have the highest precipitation rates.

Table 4.3-1Summary of the factors driving hydrogeomorphic processes for each geomorphic province. Relative rankings of the three variables provided by California Geological Survey Engineering Geologist Chris Gryszan, P.G. and Senior engineering Geologist Donald Lindsay, P.G., C.E.G., P.E..

Geomorphic Provinces	Description of Geomorphic Provinces	Tectonic Setting	Rock/Soil Strength	Topographic Relief	PPT
Colorado Desert	A low-lying barren desert basin, about 245 feet below sea level in part, is dominated by the Salton Sea. The province is a depressed block between active branches of alluvium-covered San Andreas Fault with the southern extension of the Mojave Desert on the east.	High	Low	Low	Low
Cascade Range	The Cascade Range, a chain of volcanic cones, extends through Washington and Oregon into California. It is dominated by Mount Shasta, a glacier-mantled volcanic cone, rising 14,162 feet above sea level. The southern termination is Lassen Peak, which last erupted in the early 1900s. The Cascade Range is transected by deep canyons of the Pit River. The river flows through the range between these two major volcanic cones, after winding across interior Modoc Plateau on its way to the Sacramento River	High	Moderate to High	High	High
Modoc Plateau	A volcanic table land (elevation 4,000-6,000 feet above sea level) consisting of a thick accumulation of lava flows and tuff beds along with many small volcanic cones. Occasional lakes, marshes, and sluggishly flowing streams meander across the plateau. The plateau is cut by many north-south faults. The province is bound indefinitely by the Cascade Range on the West and the Basin and Range on the east and south.	Low	Moderate	Low to Moderate	Low to Moderate
Sierra Nevada	A tilted fault block nearly 400 miles long. Its east face is a high, rugged multiple scarp, contrasting with the gentle western slope (about 2°) that disappears under sediments of the Great Valley. Deep river canyons are cut into the western slope. Their upper courses, especially in massive granites of the higher Sierra, are modified by glacial sculpturing. The northern Sierra boundary is marked where bedrock disappears under the Cenozoic volcanic cover of the Cascade Range.	Moderate	High	High	High
Great Valley	An alluvial plain about 50 miles wide and 400 miles long in the central part of California. Its northern part is the Sacramento Valley, drained by the Sacramento River and its southern part is the San Joaquin Valley drained by the San Joaquin River. The Great Valley is a trough in which sediments have been deposited almost continuously since the Jurassic.	Low	Low	Low	Low
Klamath Mountains	Rugged topography with prominent peaks and ridges reaching 6,000-8,000 feet above sea level In the western Klamath, an irregular drainage is incised into an uplifted plateau called the Klamath peneplain. The Klamath River follows a circuitous course from the Cascade Range through the Klamath Mountains. The province is considered to be a northern extension of the Sierra Nevada.	Moderate	Moderate to High	High	High

Geomorphic Provinces	Description of Geomorphic Provinces	Tectonic Setting	Rock/Soil Strength	Topographic Relief	PPT
Transverse Ranges	An east-west trending series of steep mountain ranges and valleys. The east-west structure of the Transverse Ranges is oblique to the normal northwest trend of coastal California, hence the name "Transverse." The province extends offshore to include San Miguel, Santa Rosa, and Santa Cruz islands. Its eastern extension, the San Bernardino Mountains, has been displaced to the south along the San Andreas Fault. Intense north-south compression is squeezing the Transverse Ranges. As a result, this is one of the most rapidly rising regions on earth.	Moderate to High	Low to High	High	Moderate
Basin and Range	The westernmost part of the Great Basin. The province is characterized by interior drainage with lakes and playas, and the typical horst and graben structure (subparallel, fault-bounded ranges separated by downdropped basins). Death Valley, the lowest area in the United States, is one of these grabens. Another graben, Owens Valley, lies between the bold eastern fault scarp of the Sierra Nevada and Inyo Mountains. The northern Basin and Range Province includes the Honey Lake Basin.	Moderate to High	Low to High	Low to High	Low
Peninsular Ranges	A series of ranges separated by northwest trending valleys, subparallel to faults branching from the San Andreas Fault. The trend of topography is similar to the Coast Ranges, but the geology is more like the Sierra Nevada, with granitic rock intruding the older metamorphic rocks. The Peninsular Ranges extend into lower California and are bound on the east by the Colorado Desert. The Los Angeles Basin and the island group (Santa Catalina, Santa Barbara, and the distinctly terraced San Clemente and San Nicolas islands), together with the surrounding continental shelf (cut by deep submarine fault troughs), are included in this province.	Moderate to High	High	High	Low to Moderate
Coast Ranges	Northwest-trending mountain ranges (2000 to 6000 feet a.s.l.) and valleys. The ranges and valleys trend northwest, subparallel to the San Andreas Fault. Strata dip beneath alluvium of the Great Valley. To the west is the Pacific Ocean. The coastline is uplifted, terrace and wave-cut. The Coast Ranges are composed of thick Mesozoic and Cenozoic sedimentary strata. The northern and southern ranges are separated by a depression containing the San Francisco Bay. The northern Coast Ranges are dominated by irregular, knobby, landslide-topography of the Franciscan Complex. The eastern border is characterized by strike-ridges and valley in Upper Mesozoic strata. In several areas, Franciscan rocks are overlain by volcanic cones and flows of the Quien Sabe, Sonoma, and Clear Lake volcanic fields. The Coast Ranges are subparallel to the active San Andreas Fault. West of the San Andreas is the Salinian Block, a granitic core extending from the southern extremity of the Coast Ranges to the north of the Farallon Islands.	Moderate to High	Low to Moderate	Moderate to High	Moderate to High
Mojave Desert	A broad interior region of isolated mountain ranges separated by expanses of desert plains. It has an interior enclosed drainage and many playas. There are two important fault trends that control topography: a prominent NW-SE trend and a secondary east-west trend (apparent alignment with the Transverse Ranges is significant). The Mojave province is wedged in a sharp angle between the Garlock Fault (southern boundard Sierra Nevada) and the San Andreas Fault, where it bends east from its northwest trend. The northern boundary of the Mojave is separated from the prominent Basin and Range by the eastern extension of the Garlock Fault.	High	Low to Moderate	Low to Moderate	Low

4.3.1.2.2 Hydrology

Climate influences streamflow through the interactions between temperature and the type, amount, and timing (i.e., season) of precipitation (Montgomery and Bolton, 2003). Historically, precipitation is typically dominated by snow for elevations above 4,500-6,000 feet, with the snowline typically decreasing in elevation with increasing latitude (Krutz, 1972). Rock type is an important determinant of runoff characteristics due to its effect on permeability. Some permeable rock types (e.g., young basalts) show a paucity of surface runoff and the predominance of spring-fed rather than storm dominated runoff. Runoff processes are highly nonlinear and spatially and temporally variable, partially due to topographic variability in soil moisture, slope, and vegetation (Montgomery and Bolton, 2003).

SURFACE WATERS

For the purposes of the Program EIR, surface waters occur as streams, lakes, ponds, coastal waters, lagoons, and estuaries, or found in floodplains, dry lakes, desert washes, wetlands and other collection sites. Waterbodies modified or developed by man, including reservoirs and aqueducts, are also considered surface waters. Surface water resources are very diverse due to the high variance in tectonics, topography, geology/soils, climate, precipitation, and hydrologic conditions. Overall, California has the most diverse range of watershed conditions in the U.S., with varied climatic regimes ranging from Mediterranean climates with temperate rainforests in the north coast region to desert climates containing dry desert washes and dry lakes in the southern central region.

The average annual runoff for the State is 71 million acre-feet (DWR, 1998). The state has more than sixty major stream drainages and more than 1,000 smaller, but significant basins that drain coastal mountains and inland mountainous areas. High snowpack levels (during years with normal or above normal precipitation) and resultant spring snowmelt yield high surface runoff and peak discharge in the Sierra Nevada and Cascade Mountains that feed surface flows, fill reservoirs and recharge groundwater. Federal, state and local engineered water projects, aqueducts, canals, and reservoirs serve as the primary conduits of surface water sources to areas that have limited surface water resources. Most of the surface water storage is transported for agricultural, urban, and rural residential needs to the San Francisco Bay Area and to cities and areas extending to southern coastal California. Surface water is also transported to southern inland areas, including Owens Valley, Imperial Valley, and Central Valley areas.

GROUNDWATER

The majority of runoff from snowmelt and rainfall flows down mountain streams into low gradient valleys and either percolates into the ground or is discharged to the sea. This percolating flow is stored in alluvial groundwater basins that cover approximately 40 percent of the geographic extent of the state (DWR, 2003). Groundwater recharge occurs more readily in areas underlain by coarse sediments, primarily in mountain base alluvial fan settings. As a result, the majority of California's groundwater basins are located in broad alluvial valleys flanking mountain ranges, such as the Cascade Range, Coast Ranges, Transverse Ranges, and the Sierra Nevada.

There are 250 major groundwater basins that serve approximately 30 percent of California's urban, agricultural and industrial water needs, especially in the southern portion of San Francisco Bay, the Central Valley, greater Los Angeles area, and inland desert areas where surface water is limited. On average, more than 15 million acre-feet of groundwater are extracted each year in the state, of which more than 50 percent is extracted from 36 groundwater basins in the Central Valley. Over-pumping has become a major concern in the last two decades.

4.3.1.2.3 Hydrology by Geomorphic Province

This section provides a narrative description of hydrology by geomorphic province based on Rantz (1972). Terminology discussed in the narrative follows that outlined by Rantz (1972) in Table 4.3-2.

Table 4.3-2. Runoff classification by precipitation zones (Rantz, 1972). This terminology is used in the narrative descriptions of hydrology by geomorphic province below.

Precipitation zone	Mean annual precipitation (in)	Mean annual runoff (in)	Duration of flow in an average year
Arid	Less than 10	Less than 0.5	A few days to a few weeks
Semiarid	10-20	0.3-5.0	A few days to 275 days
Sub-humid	20-40	3-20	90-365 days
Humid	More than 40	More than 10	335-365 days

COLORADO DESERT AND MOJAVE DESERT

The Colorado Desert and Mojave Desert geomorphic provinces display very similar runoff characteristics (Rantz, 1972). Both provinces are arid, with most of the precipitation occurring during winter storms or during convective storms during the summer. Rainfall intensity is generally higher during the summer, but these types of storms will only generally produce runoff for a few days. In some cases, many years may elapse between runoff generating events. Perennial springs exist in both provinces, but are generally discontinuous as surface flow is rapidly infiltrated into the ground as it progresses from the spring source.

CASCADE RANGES AND MODOC PLATEAU

Similar rock types in the Cascade Range and Modoc Plateau geomorphic provinces (i.e., young volcanic rocks) means that the runoff characteristics of watercourses are similar. The precipitation in these provinces range from humid on the westward side of the Cascade Ranges to semiarid in eastern portions of the Modoc Plateau. In general, precipitation increases in with elevation and decreases in an eastward direction. Snowmelt is an important runoff mechanism in much of the area due to the relatively high elevations associated with the two provinces. Due to the permeability of the young volcanic rocks, water is rapidly infiltrated and typically emerges as baseflow. As a result, watercourses are not as responsive to precipitation inputs as in areas with less permeable rock types. The density of watercourses in an area is typically lower due to the high permeability of the surface rock and the general lack of erosive surface flows on young volcanic rock types (Jefferson et al., 2010).

SIERRA NEVADA

Mean annual precipitation for the Sierra Nevada increases with increasing altitude and with increasing latitude. In general, westward slopes receive more precipitation than leeward slopes. Mean annual precipitation fluctuates from 10 inches in the southeast portion of the province to 90 inches in the Feather River basin. As a result, mean annual runoff varies considerably across the province. Snowmelt runoff is the dominant runoff mechanism for most of the large hydrologic basins. Rainfall-related storm runoff is more important for low altitude basins (e.g., Fresno, Calaveras, and Bear River watersheds) and for foothill tributary streams. Baseflow is more dominant on eastside streams due to the highly fractured nature of the underlying bedrock, whereas the west side streams have a more variable base flow depending upon the permeability of the underlying bedrock.

GREAT VALLEY

The Great Valley is a low altitude province with annual precipitation ranging from arid in the south to humid in the north. Latitude is the primary determinant of precipitation magnitude. As a result, runoff is typically greatest in the north and lowest in the south. Due to the overall low elevation of the province, snowmelt is not a factor in the hydrology of the province. Streams that originate entirely within the Great Valley province are typically intermittent or ephemeral due to the high permeability of valley alluvium and to the long dry season. Streams originating in the humid mountains around the Valley are typically perennial in nature, but may still lose runoff through seepage to the valley alluvium. Streams originating in the southern portions of the Coast Ranges that drain to the Great Valley are generally ephemeral or intermittent due to seepage losses.

KLAMATH MOUNTAINS

The Klamath Mountain province ranges from humid in the west to semiarid in the east. Precipitation generally decreases from west to east, and increases with elevation. In general, precipitation decreases with distance from the ocean, and increases with elevation. The Klamath Mountains are characterized by highly variable precipitation, with the higher altitudes in the coastal Smith River basin having mean annual precipitation of 120 inches, whereas the Shasta River valley in the east only has an annual precipitation magnitude of 10 inches. Snowmelt is the dominant runoff mechanism for watersheds with much of their elevation over 4,500 feet, whereas storm flow is the more common runoff mechanism when the majority of the watershed is below 4,500 feet. Base flow is well sustained with the exception of small, low altitude watersheds where streams can run dry during summer or early fall.

COAST RANGES

Mean annual precipitation for the Coast Ranges geomorphic province ranges from humid in the north to arid in the southeast. Annual precipitation generally increases with altitude, and when a slope is west-facing or windward. As a result, annual runoff is highest in the northern part of the province and on westward facing slopes. Runoff is generally perennial in the north, but intermittent or ephemeral in the southern portions of the Coast Ranges. Storm runoff is generally the dominant runoff mechanism in the province, but the Yolla Bolly Mountains in the northern portion of the province have an important snowmelt component. There is a substantial difference in runoff regimes between the northern and southern portions of the Coast Ranges, due to the fact that the southern portion of the Coast Ranges doesn't receive storm runoff until later in the winter season.

TRANSVERSE RANGES

The mean annual precipitation of the Transverse Ranges geomorphic province varies from sub-humid to semiarid. Mean annual precipitation increases with altitude and reaches a maximum of 40 inches in some areas. Precipitation is usually higher on south facing slopes than on north slopes. Runoff magnitude follows that of precipitation magnitude. Snowmelt can be a dominant runoff mechanism in watersheds above 6,000 feet. Streams draining alluvial basins only flow during intense storms and most of the runoff can occur in a few days per year. Areas with low rock permeability exhibit flashy runoff response, and 50 percent of the annual runoff may occur in less than 60 days of the year. More permeable lithologies or higher elevation watersheds may have a higher duration of flow throughout the year, with base flow being sustained throughout the summer (e.g. East Fork of the San Gabriel River).

PENINSULAR RANGES

The mean annual precipitation for the Peninsular Ranges geomorphic province varies from sub-humid to arid. Higher elevations receive more precipitation with a maximum magnitude of approximately 40 inches per year. Precipitation is generally higher on the western side of the ranges than on the eastern side. The eastern sides may only receive approximately three inches per year. The spatial pattern of annual runoff mirrors annual precipitation. Snowmelt can be an important runoff process in the higher altitudes, particularly in the northeast portion of the province (i.e. Mount San Jacinto). Streams in the alluvial basins react similarly to those in the Transverse Ranges.

BASIN AND RANGE

The Basin and Range province ranges from arid to semi-arid; with a small area in the north that exhibits a sub-humid environment. Mean annual precipitation and runoff increases with altitude and from south to north. The northern portions of the Basin and Range receive precipitation from winter frontal storms and summer convective storms, and these areas have significant snowmelt runoff. The portion of the province near Goose Lake is underlain by volcanic rocks and has well sustained base flow. The portion of the province draining to Honey Lake is underlain by sedimentary rock has less persistent base flow than the far northern portion. The southern portion of the Basin and Range province on the lee side of the Sierra Nevada receives most of its precipitation during winter frontal storms. Snowmelt is a significant runoff source and base flow can be fairly well sustained. The southernmost arid portion of the Basin and Range is subject to convective summer storms and runoff typically occurs during very short duration runoff events.

4.3.1.2.4 Soils

Soil conditions in California are extremely variable and reflect a diversity of geologic, topographic, climatic, temporal, and vegetative conditions that influence soil formation and composition (Jenny, 1994). Soils are not unique to specific regions or have specific characteristics or properties that distinguish them from other soils. Instead of specific properties that define a regional soil, there is a general gradational transition between the properties of one soil compared to another. As a result, a regional evaluation of soils beyond inventory data is not informative or useful in the context of the VTP PEIR. Rather, a general discussion of soil properties are provided.

Soils can be classified using a variety of methods depending on the application of the information. Engineers use classification methods that evaluate the engineering properties of a soil (e.g., Unified Soil Classification System). Soil scientists typically use classification methods that group soils by their intrinsic properties, geologic origin, and soil behavior in different conditions. The U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) utilizes the USDA soil taxonomy system for the classification of soils. This classification is based on chemical, biological, and physical characteristics of soils, including soil color, texture, structure, mineralogy, salt content, and depth. These characteristics are defined in Chapters 2 and 3 of the 1993 USDA Soil Survey Manual and Soils and Geomorphology authored by Peter Birkeland (1984).

The NRCS has completed comprehensive soil surveys through the NRCS National Cooperative Soil Survey, a nationwide partnership of federal, state, and local agencies that among other things, investigate, classify, interpret, disseminate, and maintain information about soils in the U.S. Soil surveys have been conducted throughout California by the NRCS and information is provided in the U.S. General Soil Map (STATSGO2) and the Soil Survey Geographic (SSURGO2) digital databases. STATSGO2 provides state general soils maps based on generalized soil survey data and is designed as a tool for county, state, regional, and national resource planning and management. SSURGO2 provides detailed soil maps based on field and air photo surveys conducted by the NRCS at scales of 1:15,840 to 1:31,680. These databases not only provide spatial data, but also provide specific soil property data and analyses of potential soil hazards (e.g., soil erodibility). This information should be used when evaluating soils affected by change-in-use projects pursuant to the proposed Program.

SOIL ORDER

Soil Order represents the broadest category of soils using the USDA "Soil Taxonomy." Soil Taxonomy is a basic system of soil classification. There are 12 soil orders, differentiated by the presence or absence of diagnostic horizons: Alfisols, Andisols, Aridisols, Entisols, Gelisols, Histosols, Inceptisols, Mollisols, Oxisols, Spodosols, Ultisols, and Vertisols. Orders are divided into Suborders and the Suborders are farther divided into Great Groups. Ten of the twelve soil orders can be found in California. The following descriptions come from the USDA NRCS web site: soils.usda.gov.

Alfisols: Alfisols are found in semi-arid to moist areas. These soils result from weathering processes that leach clay minerals and other constituents out of the surface layer and to the subsoil, where they can hold and supply moisture and nutrients to plants. They are formed primarily under forest or mixed vegetative cover and are productive for most crops. Alfisols are considered a more productive order of soils.

Andisols: The central concept of Andisols is that of soils dominated by short-range-order minerals. They include weakly weathered soils with much volcanic glass as well as more strongly weathered soils. Hence the content of volcanic glass is one of the characteristics used in defining andic soil properties. Materials with andic soil properties comprise 60 percent or more of the thickness between the mineral soil surface or the top of an organic layer with andic soil properties and a depth of 60 cm or a root limiting layer if shallower. Andisols are considered a more productive order of soils.

Aridisols: The central concept of Aridisols is that of soils that are too dry for mesophytic plants to grow. They have either (1) an aridic moisture regime and an ochric or anthropic epipedon and one or more of the following with an upper boundary within 100 cm of the soil surface: a calcic, cambic, gypsic, natric, petrocalcic, petrogypsic, or a salic horizon or a duripan or an argillic horizon, or (2) a salic horizon and saturation with water within 100 cm of the soil surface for one month or more in normal years. An aridic moisture regime is one that in normal years has no water available for plants for more than half the cumulative time that the soil temperature at 50 cm below the surface is greater than 5° C. and has no period as long as 90 consecutive days when there is water available for plants while the soil temperature at 50 cm is continuously greater than 8° C.

Entisols: The central concept of Entisols is that of soils that have little or no evidence of development of pedogenic horizons. Many Entisols have an ochric epipedon and a few have an anthropic epipedon. Many are sandy or very shallow.

Histosols: The central concept of Histosols is that of soils that are dominantly organic. They are mostly soils that are commonly called bogs, moors, or peats and mucks. A soil is classified as a Histosol if it does not have permafrost and is dominated by organic soil materials.

Inceptisols: The central concept of Inceptisols is that of soils of humid and subhumid regions that have altered horizons that have lost bases or iron and aluminum but retain some weatherable minerals. They do not have an illuvial horizon enriched with either silicate clay or with an amorphous mixture of aluminum and organic carbon. Inceptisols may have many kinds of diagnostic horizons, but argillic, natric kandic, spodic and oxic horizons are excluded.

Mollisols: The central concept of Mollisols is that of soils that have a dark colored surface horizon and are base rich. Nearly all have a mollic epipedon. Many also have an argillic or natric horizon or a calcic horizon. A few have an albic horizon. Some also have a duripan or a petrocalic horizon. Mollisols are considered a more productive order of soils.

Spodosols: The central concept of Spodosols is that of soils in which amorphous mixtures of organic matter and aluminum, with or without iron, have accumulated. In undisturbed soils there is normally an overlying eluvial horizon, generally gray to light gray in color, that has the color of more or less uncoated quartz. Most Spodosols have little silicate clay. The particle-size class is mostly sandy, sandy-skeletal, coarse-loamy, loamy, loamy- skeletal, or coarse-silty.

Ultisols: The central concept of Ultisols is that of soils that have a horizon that contains an appreciable amount of translocated silicate clay (an argillic or kandic horizon) and few bases (base saturation less than 35 percent). Base saturation in most Ultisols decreases with depth.

Vertisols: The central concept of Vertisols is that of soils that have a high content of expanding clay and that have at some time of the year deep wide cracks. They shrink when drying and swell when they become wetter. Vertisols are considered a more productive order of soils.

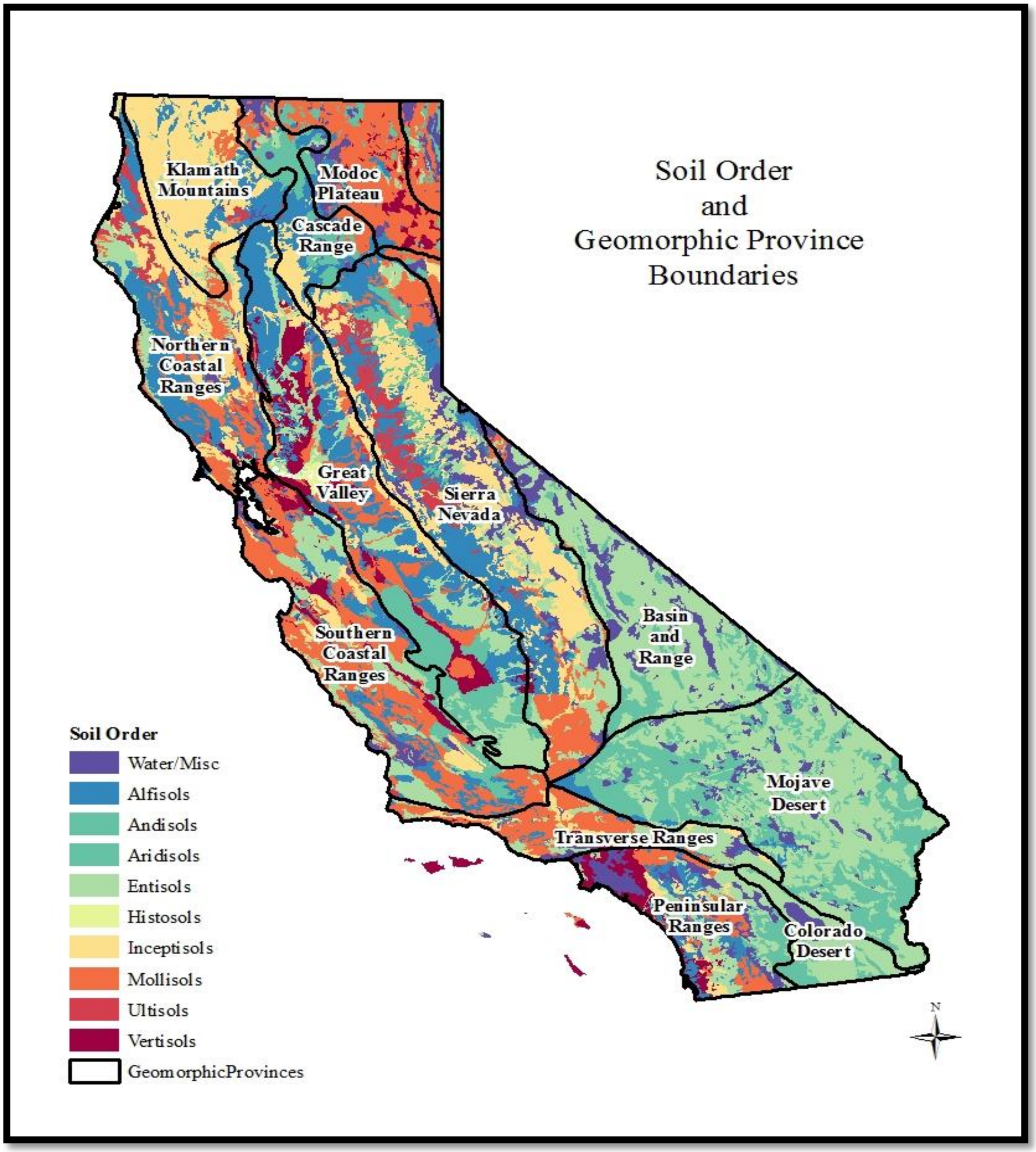


Figure 4.3-6 Soil order by geomorphic province.

SOIL ORDERS BY GEOMORPHIC PROVINCE

Table 4.3-3 Soil order acreage by geomorphic province

Geomorphic Provinces	Water/Misc	Alfisols	Andisols	Aridisols	Entisols	Histosols	Inceptisols	Mollisols	Ultisols	Vertisols	Total by Bioregion
Basin and Range	1,853,263	50,380	60,228	1,369,269	5,779,892		60,479	1,007,947		53,202	10,234,661
Cascade Range	284,592	917,058	1,094,468	56,428	122,783		498,894	562,108	17,026		3,553,357
Colorado Desert	222,093			533,528	1,508,223				39,399		2,303,244
Great Valley	81,462	4,202,823		1,808,932	2,719,748	208,121	1,054,494	1,903,976	60,881	1,656,260	13,696,697
Klamath Mountains	75,595	1,078,560	165,963		123,590		3,990,214	342,022	520,113		6,296,057
Modoc Plateau	430,465	317,434	177,827	306,962	30,234		14,419	2,811,174		358,048	4,446,562
Mojave Desert	874,872	305,371		6,119,805	8,428,591		16,547	11,077			15,756,263
Northern Coastal Ranges	136,981	2,882,494	23,175		962,023		2,178,749	1,827,452		118,025	8,128,900
Peninsular Ranges	1,089,628	819,379		454,385	1,371,378		355,959	865,601		720,169	5,676,498
Sierra Nevada	1,674,526	3,713,580	910,433	80,440	1,854,985		4,781,607	1,895,850	1,252,368	64,610	16,228,399
Southern Coastal Ranges	391,776	1,532,601		691,406	2,208,959	3,076	689,035	4,560,026	26,216	687,906	10,791,002
Transverse Ranges	321,226	231,824		30,699	1,130,694		536,263	1,429,071	2,583	59,420	3,741,779
Total by Soil Order	**7,436,480**	**16,051,503**	**2,432,093**	**11,451,855**	**26,241,099**	**211,197**	**14,176,662**	**17,216,304**	**1,918,586**	**3,717,640**	**100,853,419**

Table 4.3-3 shows soil orders by geomorphic province. The Cascade Range, Great Valley, Coast Ranges, and Modoc Plateau all have greater than 50 percent of their area in more productive soil orders (i.e., Alfisols, Andisols, Mollisols, and Vertisols). The arid Colorado Desert, Mojave, and Basin and Range Provinces have 0, 2, and 11 percent of the land in more productive soil orders, respectively.

4.3.1.2.5 Process Domains

The hydrogeomorphic processes operating across the landscape are not uniform in time and space. Rather, the landscape should be viewed as a mosaic of process domains – areas where distinct and systematic sets of hydrogeomorphic processes that govern the response of water quality, physical habitat, and biotic response to natural and anthropogenic disturbance (Montgomery, 1999). In terms of hierarchy, process domains are typically nested within areas with similar lithology and/or topography (Montgomery, 1999). Figure 4.3-7 demonstrates the concept of process domains at the watershed scale. Generalized and specific process domains within the scope of the affected area are summarized in Table 4.3-4.

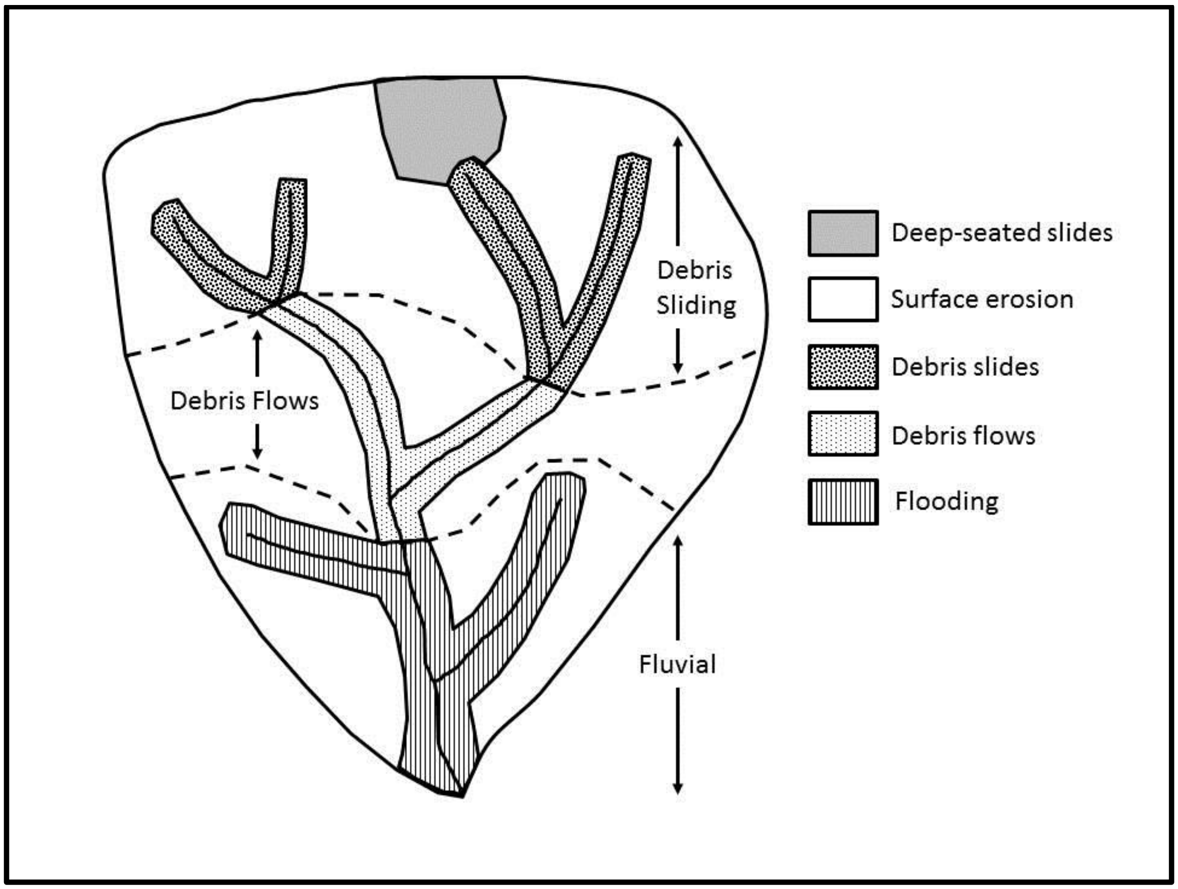


Figure 4.3-4.3-7 An example of linked process domains in a hypothetical watershed (adapted from Montgomery, 1999).

Table 4.3-4 Characteristics of erosion processes within the affected area (adapted from Reid 2010).

Erosion Process	Grain Size	Sediment Input Timing	Location	Potential Influences
Rainsplash	Fine	During intense or high magnitude precipitation events	Hillslopes with low ground cover	Disaggregating soil particles, Accelerated runoff through soil sealing
Sheetwash and rilling	Fine	During intense or high magnitude prcipitation events where runoff concentrates and flows at erosive velocities	Hillslopes with low ground cover, Compacted hillslopes, Convergent slopes	Accelerated runoff, Increased hillslope sediment delivery, Alered soil productivity
Gully erosion	Fine to medium	Periods of runoff, Early season flows	Hillslopes with low cover, Compacted hillslopes, Small to medium watercourses	Accelerated runoff, Increased sediment hillslope delivery, Lowered water table, Altered soil productivity, Increased bank erosion, Altered watercourse form, Reduced floodplain connectivity
Bank erosion	Fine to medium	High flows, After high flows	Moderate to large watercourses	Altered woody debris, riparian vegetation, and watercourse form
Soil creep	Fine to medium	Chronic	Pervasive	Increased bank erosion
Debris slides	Fine to course	High-intensity rain onto wet ground	Inner gorges, Convergetnt slopes/hollows, Undercut banks, Certain lithologies, Toes of deep-seated slides	Flow deflection, Altered soil productivity
Deep-seated slides	Fine to very course	Very wet seasons	Certain lithologies or geologic structures	Flow deflection, Altered soil productivity
Earthflows	Fine to very Course	Very wet seasons	Certain lithologies or geolofic structures	Flow deflection, Altered soil productivity
Debris flows	Fine to course	High-intensity rain onto wet ground	Convergent slopes, Certain lithologies	Altered watercourse roughness, Flow deflection, Altered woody debris, Watercourse blockage

4.3.1.2.5.1 Unstable Hillslopes

Unstable hillslopes, also known as unstable areas, refer to areas susceptible to landsliding. Landslides consist of the downslope movement of soil and rock under the influence of gravity. The geologic and topographic features of the landscape are the primary determinants of the shear strength of the hillslope materials (i.e., resistance to landslides) and hillslope shear stress (i.e., propensity for landsliding). Landslides occur when the shear stress exceeds the shear strength of the materials forming the slope (Selby, 1982). Climate and vegetative cover also affect landslide hazard because of their influence on soil root support and moisture.

Factors contributing to high shear stress on hillslopes include:

- steep slopes
- high mass loading (e.g., through high soil moisture levels or placement of fill material)
- slope undercutting (e.g., through erosion or excavation)
- soils that vary in volume (shrink and swell) in relation to moisture content

Factors contributing to low shear strength of hillslope materials include:

- bedding planes that dip in the same direction as the slope at the same or a lesser degree of steepness
- high water pressure in soil pores (e.g., saturated soil underlain by a restrictive layer)
- presence of faults or joints
- weak materials (e.g., soft soils or rock, unconsolidated materials, fine grain size) (Selby, 1982)

The best indicator of high landslide potential is evidence of previous landsliding (Gray and Leiser, 1982).

Landslides can be classified as active or dormant, based on how recently they have moved. Active landslides typically display cracks or sharp, bare scarps. Vegetation is usually more sparse on active landslides than on adjacent stable ground; if trees are present, they are usually “jackstrawed” (i.e., leaning), indicating that ground movement has occurred since they became established. Dormant landslide features have typically been modified by weathering, erosion, and vegetative growth and succession.

Active landslides are generally more unstable than dormant landslides and may require mitigation measures to avoid mobilization. Excavation, the use of heavy equipment, soil saturation, or the removal of root support can mobilize active landslides. Although dormant landslides are less likely to be mobilized by human activities, portions of dormant landslides (e.g., their steep headwalls and margins) are often unstable.

Several types of landslides and associated landforms can be associated with vegetation management in California and are described below. These landforms have distinct hazard indicators and require special management practices to reduce the hazard.

TRANSLATIONAL AND ROTATIONAL DEEP-SEATED LANDSLIDES

Translational and rotational landslides are moderate or slow, relatively deep-seated movements of typically cohesive rock masses. These movements commonly occur along bedrock bedding planes that dip parallel to the surface, as may be observed at rock outcroppings. Translational slides consist of downward displacements of material parallel to the ground surface; they commonly occur along bedding planes, faults, and contacts between bedrock and overlying deposits. Rotational slides (or “slumps”) occur along a well-defined curved surface and are likely to occur in incompetent, clayey bedrock material under saturated soil conditions. Most translational and rotational slides feature a nearly vertical scarp near their head or sides. Slide deposits are typically hummocky. The presence of sag ponds or wet-site vegetation may indicate the impaired drainage that is characteristic of slide deposits.

EARTH FLOWS

Earth flows consist of the slow movement of saturated soil and debris, often following a slump. They are composed of clay-rich materials that swell when wet, thus reducing intergrannular friction and shear strength. They usually occur in areas where low soil permeability restricts groundwater movement. They often feature hummocky, highly erodible surfaces.

DEBRIS SLIDES

Debris slides refer to the movement of unconsolidated material along a shallow, flat failure plane. They usually occur on slopes exceeding 65 percent where shallow bedrock forms an impervious layer that concentrates water near the surface. Debris slides often occur during intense storms in response to excessive pore water pressure within the saturated surface layer. As with other landslides, the presence of bedding planes aligned parallel to the slope is an indicator of high debris slide hazard.

Debris slide amphitheaters and slopes are characterized by steep slopes that have been sculpted by many debris slides. Although areas within these landforms are typically well-vegetated, they usually also feature debris slide scars, incised depressions, areas of active debris sliding, and exposed bedrock.

DEBRIS FLOWS

Debris flows are often initiated by the discharge of material into a stream channel from debris slides on adjacent hillslopes or by failure of fill materials at stream crossings caused by high flows. Debris flows are common when debris slide source areas are connected to steeper watercourse channels (Benda et al. 2005). Post-fire debris flows are well noted in the Transverse and Peninsular Ranges provinces (Wells, 1987), but will also happen in other areas where hillslopes are sufficiently steep to initiate debris sliding (Benda et al., 2005).

INNER GORGES

Inner gorges are over steepened stream banks extending from the stream channel to the first break in the slope above the channel. The slope generally exceeds 65% and is formed by debris sliding and erosion caused primarily by the down cutting of the stream channel and undercutting of landslide toes by stream erosion (CGS, 2013).

LANDSLIDE SUSCEPTIBILITY

Landslide susceptibility is the relative likelihood that landsliding will occur. For the purposes of demonstrating landslide susceptibility for the affected area, landsliding can be broken into two categories; shallow-seated and deep-seated landsliding. Shallow-seated landsliding occurs in the regolith – the unconsolidated earth material and soil overlying bedrock. Deep-seated landsliding occurs below the regolith and includes failure into bedrock. Shallow landsliding typically occurs on slopes greater than 65 percent (CGS, 2013), and in steep, convergent areas. Deep-seated landsliding is primarily a function of rock strength and slope, but it is also affected by precipitation and earthquake potential (CGS, 2011). Shallow-landsliding occurrence is most likely to occur in the mountainous portions of the Coast Ranges, Klamath Mountains, Transverse Ranges, and the Sierra Nevada (Figure 4.3-4). Figure 4.3-9 shows the modeled susceptibility for deep-seated landsliding performed by the California Geological Survey (2011). Figure 4.3-9 indicates that the highest susceptibility for deep-seated landsliding is in the Coast Ranges, Klamath Mountains, and Transverse Ranges provinces.

4.3.1.2.5.2 Stable Hillslopes

Stable hillslopes are ones that are not susceptible to landsliding, but may be subjected to surface erosion processes. Surface erosion caused by water—the most important agent of erosion from a vegetation management perspective—occurs when the shear stress of water flowing over a slope exceeds the shear resistance of soil particles. The susceptibility of a soil to detachment (i.e., shear resistance) and transport by flowing water varies widely among soils with differing textures; a silt loam soil, for example, may be more than 30 times more erodible than a gravelly clay loam (USDA, 1993).

Surface erosion is classified into four general types: rain splash, sheet, rill, and gully erosion (Figure 4.3-8). Sheet erosion is the removal of soil of a generally uniform depth across a slope and is caused by non-concentrated runoff. Rill erosion refers to the removal of soil in shallow (i.e., less than approximately 6 inches deep), usually parallel, channels from a slope and is caused by concentrated runoff. Gully erosion consists of removal of soil from deeper channels and is also caused by concentrated runoff. Although usually less conspicuous than rill and gully erosion, sheet erosion tends to result in greater soil loss over a wide area.

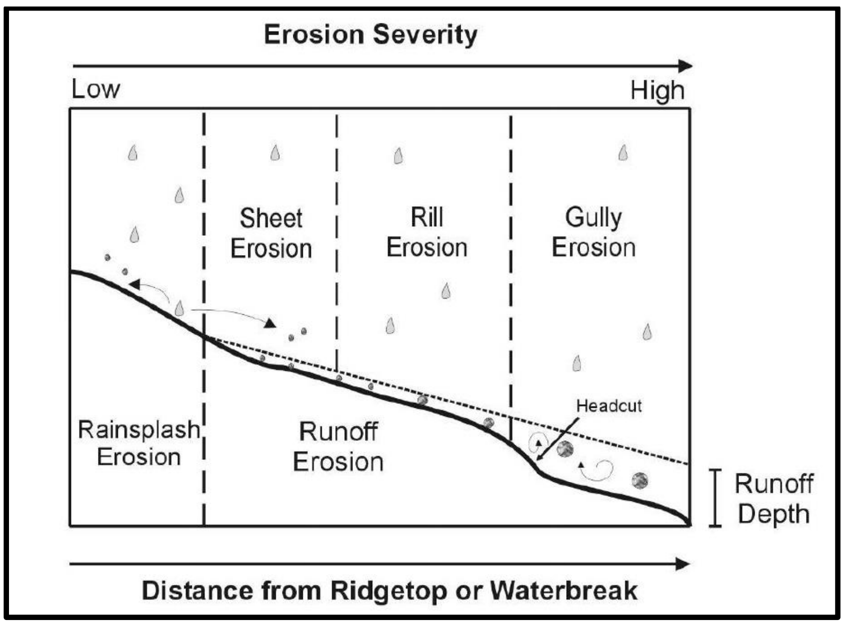


Figure 4.3-4.3-8 Erosion process and erosion severity as a function of distance from ridgetop or distance downslope of water break. Erosion severity increases as more runoff accumulates in the downslope direction (Central Valley Regional Water Quality Control Board, 2010).

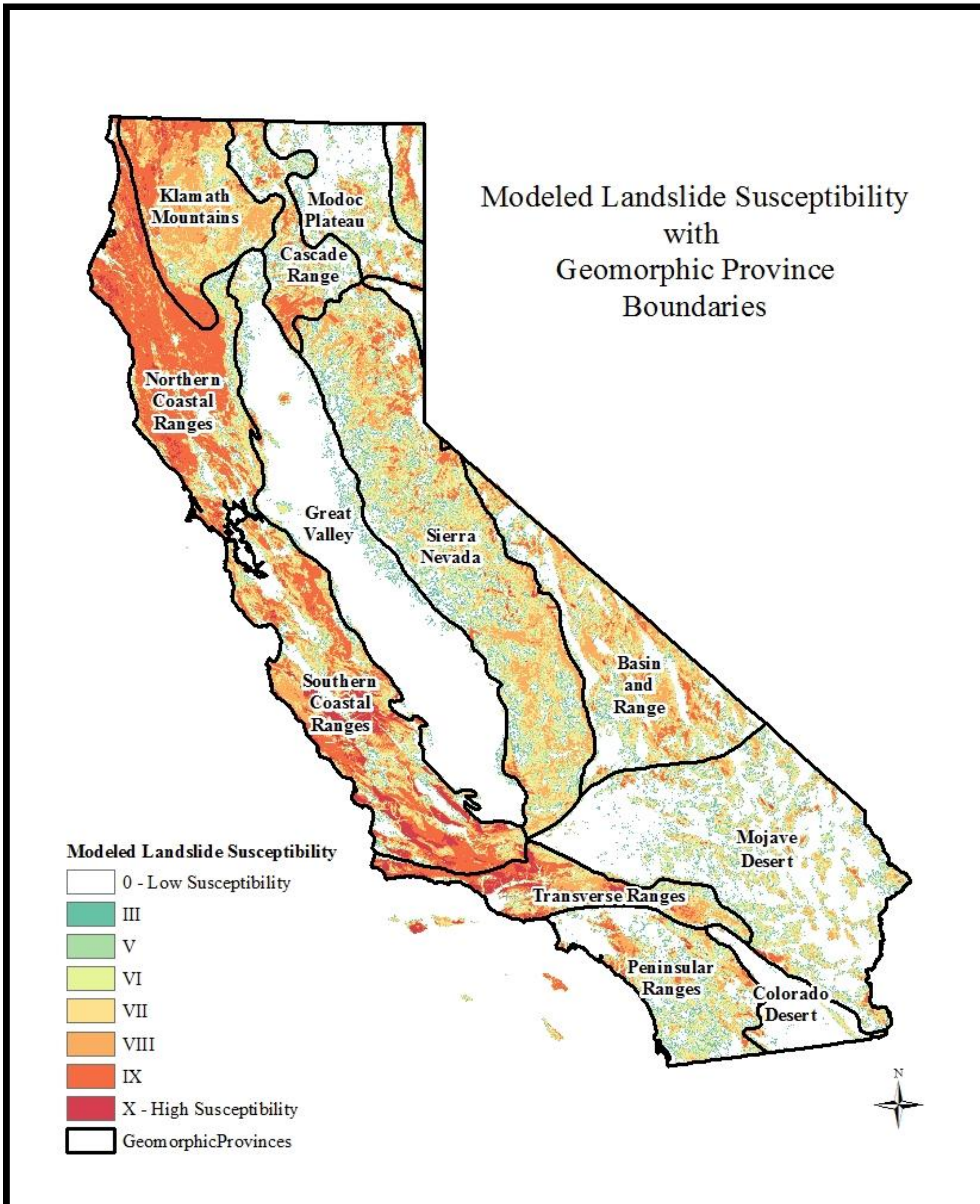


Figure 4.3-4.3-9 Deep-seated landsliding susceptibility based on rock strength and slope. The Coast Ranges, Klamath Province, and Transverse Ranges have the highest likelihood for deep-seated landsliding. Data taken from CGS (2011).

The force of raindrops falling contributes to water erosion. The raindrops dislodge and mobilize soil particles, causing a net downslope soil movement. Raindrops falling on bare soil also causes fine soil particles to plug soil pores, resulting in a crust on the soil surface that may increase runoff rates.

The factors that most influence the inherent wind erodibility of a soil are soil texture, organic matter content, calcium carbonate content, cohesion and gravel content (USDA, 1993). Wind erosion hazard is greatest where such soils occur and high winds are common, vegetation cover has been removed, and the soil has been disturbed.

EROSION HAZARD RATING

Each soil survey map unit is rated for water erosion hazard. The erosion hazard rating is qualitative; a typical range is slight/low to severe/extreme. The erosion hazard rating indicates the tendency of erosion to occur when the soil is barren of vegetation or when the soil is disturbed. The primary factors that control water erosion hazard are slope gradient, soil texture, and vegetative cover. Other factors include length of slope, organic matter content, structure (i.e., aggregation characteristics), permeability, and gravel content. Erosion hazard ratings using the Revised Universal Soil Loss Equation (RUSLE) are shown for California in Figure 4.3-10.

4.3.1.2.5.3 Channels and Floodplains

HEADWATER CHANNELS

Headwater channels are process domains where fluvial processes are dominant or partially dominant, and are associated with erosional portions of the landscape (Schumm, 1977). Channels (i.e., watercourses) begin where surface runoff is concentrated enough to cause scour and distinct banks, and typically originate in strongly convergent areas (MacDonald and Coe, 2007). Headwater channels are closely linked to sediment sources on hillslopes (MacDonald and Coe, 2007). The uppermost portions of the headwater channel network typically start out flowing over a colluvial valley fill and exhibit weak or transient fluvial transport (Montgomery and Buffington, 1997). In the downstream direction, channel slopes typically decrease, channel bedforms become more organized and regular, and fluvial processes become more dominant (Montgomery and Buffington, 1997). Channels that are steeper than two percent slope or are confined (i.e., narrow valley walls) are considered transport channels, and efficiently deliver sediment and water to downstream reaches. Unconfined channels that are less than two percent slope are typically are typically “response” channels, where depositional processes start to become dominant

(Montgomery and Buffington, 1998). Relatively steep and confined headwater channels that transition quickly to more gentle slopes and less confined valleys can induce alluvial fans – a cone-shaped landform composed of coarse-grained poorly sorted sediment (Blair and McPherson,1994). Alluvial fans are subject to flooding and/or shifting/migrating channels (Slingerland and Smith, 2004).

FLOODPLAIN CHANNELS

Floodplain channels are process domains where fluvial processes are dominant, and are characterized by low channel slopes and wide valleys. These channels generally occupy depositional portions of the landscape (Schumm 1977), and are generally disconnected from hillslope sediment sources (Montgomery and Bolton, 2003). (Montgomery and Bolton, 2003). As opposed to headwater channels and valleys, floodplain channel and valleys are primarily a sediment accumulating system rather than a sediment-evacuating system (Church, 2002). Floodplain channels are often subject to meandering, channel-shifting (i.e., avulsion), and flooding (Montgomery, 1999).

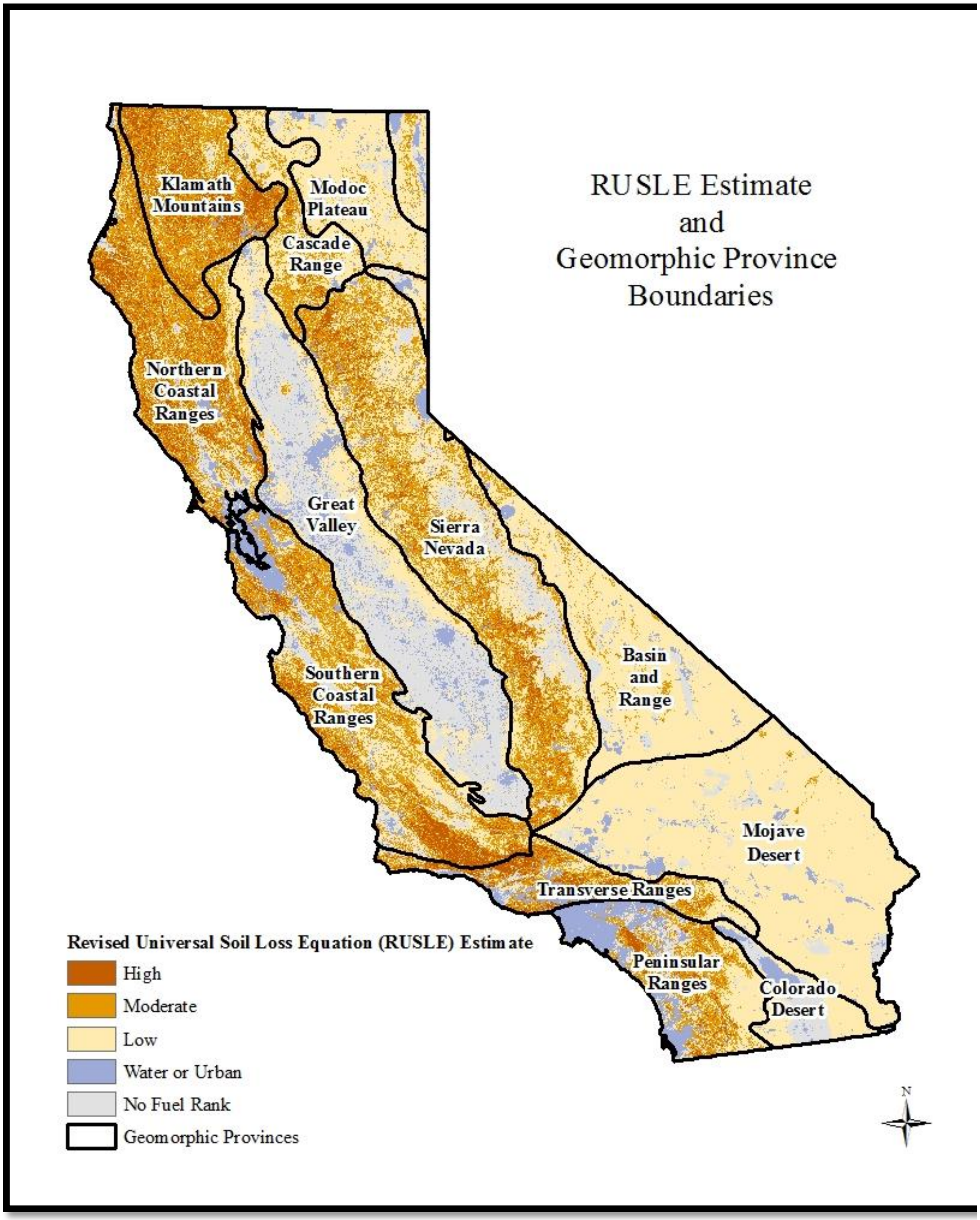


Figure 4.3-10 Erosion hazard classes determined through the use of the Revised Universal Soil Loss Equation (RUSLE).

4.3.2 EFFECTS

4.3.2.1 Significance Criteria

The following significance criteria have been developed based on the "Geology and Soils" and "Hydrology and Water Quality" sections of CEQA Appendix G: Environmental Checklist Form of the State CEQA Guidelines. The impact of the Program on geology, hydrology, and soils would be considered significant if projects that qualify for implementation under the proposed Program would:

- Be located on unstable geologic units or soils, including expansive soils, or located on geologic units or soils that could become unstable as a result of the project, resulting in ground failures.
- Exposure of people or structures to the risk of loss, injury, or death involving landslides.
- Result in substantial soil erosion or loss of topsoil.
- Substantially deplete groundwater supplies or interfere substantially with groundwater recharge, such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level.
- Substantially alter the existing drainage pattern of the site or area, including through alteration of the course of a stream or river, in a manner that would result in substantial erosion or sedimentation on- or off-site.
- Create or contribute runoff water that would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff.
- Place housing within a 100-year flood hazard area, as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map, or other flood hazard delineation map.
- Place structures within a 100-year flood hazard area that would impede or redirect flood flows.
- Expose people or structures to a significant risk of loss, injury, or death from flooding, including flooding resulting from the failure of a levee or dam.
- Inundation by seiche, tsunami, or mudflow.

Numerical modeling to determine threshold exceedance of these listed criteria is too difficult to perform given the potential scale of the Program, the high spatial and temporal variability in hydrogeomorphic processes (MacDonald and Coe, 2007), and the lack of most numerical models to adequately model these physical processes at scales relevant for this Program EIR (Murray, 2003). Criteria A, B, and J will be evaluated on whether Program activities will trigger landsliding or will increase the probability that landslides are initiated.

4.3.2.2 Analysis assumptions

This analysis will consider the characteristic impact of the various fuels reduction activities (e.g., mechanical, fire) on geologic, hydrologic, and soil resources within the context of the Program and associated alternatives. Since roads are used to access the project areas, and roads are well-noted sources of runoff and sediment (Luce and Wemple, 2001), roads are also considered in this analysis.

GENERALIZED HYDROGEOMORPHIC IMPACTS OF FUELS REDUCTION ACTIVITIES

Tables 4.3-5 through 4.3-7 summarizes the hydrogeomorphic impacts of the various fuels reduction activities. for the likelihood of impacts are highest for areas with a higher soil burn severity and for treatments that cause more compaction and/or bare soils (Robichaud et al., 2010). As a result, it is assumed that the highest likelihood of impacts will occur for prescribed fire and mechanical treatments, particularly in shrub dominated vegetation types, as these activities will result in almost the full removal of vegetation and the post-treatment recovery time is likely highest for chaparral. Road use during project operations may also result in impacts. Detailed summaries of generalized hydrogeomorphic impacts from fuel reduction activities in the western United State are covered in Elliot et al. (2010)

Table 4.3-5 Impacts to geologic, hydrologic, and soils resources from prescribed fire activities.

Prescribed Fire		
Activity	Impact Type	POTENTIAL IMPACTS TO GEOLOGIC, HYDROLOGIC, AND SOIL RESOURCES
Pile Burn	Soil disturbance	Pile burning can completely consume the duff and organic layer under high soil burn severity (Reid, 2010). Removing the organic layer can expose mineral soil to rain splash and overland flow. Combustion of organic matter within the mineral soil can cause soil disaggregation, further increasing soil erodibility (DeBano et al., 1998). Heating from the burn pile may create a water repellent layer in the soil.
	Increased runoff	Water repellency and the increased likelihood of soil sealing can lead to overland flow generation. (Larsen et al., 2009; Robichaud et al.,, 2010).
	Increased fluvial erosion	Increased overland flow and exposure of mineral soil can lead to rain splash, sheetwash, and rill erosion within the footprint of the burn pile (Reid 2010; Robichaud et al., 2010).
Broadcast Burn	Soil disturbance	Broadcast burning can remove litter and surface fuels under low soil burn severity, or can completely consume the duff and organic layer under high burn severity. Removing the organic layer can expose mineral soil to rain splash and overland flow. Combustion of organic matter within the mineral soil can cause soil disaggregation, further increasing soil erodibility. Increased water repellency and the breakdown of soil structure will reduce the infiltration rate, and thereby increase erosion potential (Robichaud et al., 2010).
	Increased runoff	If soil burn severity is high, post-fire reduction of infiltration capacity and the increased likelihood of soil sealing will lead to overland flow generation. Burning large areas can result in the excess surface flow being routed to convergent areas and low order streams (Robichaud et al., 2010).
	Increased fluvial erosion	If burn severity is high, increased overland flow and exposure of mineral soil can lead to rain splash, sheetwash, and rill erosion (Robichaud et al., 2010). Runoff concentration in convergent areas may lead to gully erosion, and excess runoff routed into low order streams may potentially lead to bank erosion (Reid, 2010). Fire may burn large woody debris in channel, resulting in the release of stored sediment (Reid, 2010).
	Increased mass wasting	Decreased evapotranspiration will increase soil moisture, potentially increase pore pressure, thereby reducing the resistance to landsliding. Increased surface runoff may initiate debris flows in steep convergent areas. Stream adjacent hillslopes may be undercut by increased flow, thereby triggering shallow debris slides (Reid, 2010).

Table 4.3-6 Impacts to geologic, hydrologic, and soils resources from fuel reduction activities.

Mechanical, Manual, Prescribed herbivory, and Herbicides		
Activity	Impact Type	POTENTIAL IMPACTS TO GEOLOGIC, HYDROLOGIC, AND SOIL RESOURCES
Mechanical	Soil disturbance	Use of mechanical equipment can compact soils or cause rutting (Page-Roese et al., 2010), especially during saturated soil conditions. Mechanical equipment can decrease soil cover and the churning forces of tread or tire traffic can break down soil structure and increase the erodibility of the soil. Heavy equipment on steep slopes can cause extensive soil disturbance. Potential impacts will be greatest in shrub and grass-dominated areas due to complete removal of the fuels/soil cover.
	Increased runoff	Compacted soil will reduce infiltration capacity and generate overland flow (Robichaud et al., 2010). Bare soils are prone to producing overland flow through soil sealing. Equipment tracks can concentrate runoff.
	Increased fluvial erosion	Increased surface runoff and the availability of easily transportable soil increases the likelihood of rain splash, sheetwash, rill, and gully erosion (Reid, 2010; Robichaud et al., 2010).
	Increased mass wasting	Compaction from trails and soil disturbance may generate overland flow that is routed to an unstable area. Removal of vegetation may result in increased soil moisture which can reduce the resisting forces to landsliding (Reid, 2010).
Manual Hand Treatments	Soil Disturbance	Soil disturbance from hand treatments is considered neglible (Robichaud et al., 2010; McClurkin et al., 1987)
Prescribed herbivory	Soil disturbance	Mechanical force from the animal's hoof can compact soil on gentler slopes, and shear and move soil in the downslope direction. When soils have high moisture content, hoof deformation can be even deeper. Animals can form trails or paths through repeated trampling. Combination of grazing and trampling can reduce soil cover (Trimble and Mendel, 1995).
	Increased runoff	Compaction through trampling lowers the infiltration rate and increases the likelihood of overland flow. Trails and/or paths created by the animals can concentrate runoff and alter drainage patterns (Trimble and Mendel, 1995).
	Increased fluvial erosion	Increased runoff and bare erodible soil increase the likelihood of rain splash, sheetwash, and rill erosion. Animal trails/paths can concentrate runoff and initiate gullying (Trimble and Mendel, 1995; Stednick, 2010).
Herbicides	See water quality section	See hazardous materials and water quality section

4.3-7 Impacts to geologic, hydrologic, and soils resources from road activities

Roads		
Activity	Impact Type	POTENTIAL IMPACTS TO GEOLOGIC, HYDROLOGIC, AND SOIL RESOURCES
Roads	Soil disturbance	Roads require the movement of large volumes of soil and earthen material, and the road prism fundamentally alters hillslope morphology. Road surfaces are generally bare of soil cover, and road cutslopes and fillslopes are generally bare initially following road construction. Traffic can generate loose material on the road surface (dust), or traffic on wet roads can create rutting (Robichaud et al., 2010).
	Increased runoff	Road surfaces have very low infiltration rates and produce overland flow in response to low intensity rainfall events. Road cutslopes can intercept hillslope runoff pathways during larger storm events. Lack of road drainage can cause erosive runoff to accumulate. Traffic during wet conditions can create rutting on the road surface which can further concentrate runoff (Robichaud, et al., 2010).
	Increased fluvial erosion	Road surfaces, cutslopes, and fillslopes are subject to rain splash, sheetwash, rill, and gully erosion. Surface erosion increases during rainy conditions and with increased traffic. Gullies and rills can initiate below drainage structures. Streams can be diverted at road-stream crossings, and can cause extensive gullying when routed to unarmored hillslopes (Reid, 2010; Robichaud et al., 2010).
	Increased mass wasting	Oversteepened fill placement can increase the risk of landsliding. Cutslopes can remove the support for upslope areas. Road drainage and diverted streams can initiate landslides below the road (Reid, 2010).

GENERALIZED HYDROGEOMORPHIC IMPACTS BY GEOMORPHIC PROVINCE

This analysis uses the geomorphic province as a hierarchical unit for analyzing impacts from the Program and the alternatives. Table 4.3-1 summarized each geomorphic province with regard to tectonic setting, rock/soil strength, topographic relief, and precipitation. The relative impact of the Program and Alternatives on geologic, hydrologic, and soil resources is illustrated in Figure 4.3-11. This figure assumes that the highest impacts will be in geomorphic provinces where the tectonic setting is characterized as high, the rock/soil strength is characterized as low, the topographic relief is characterized as high, and the precipitation is characterized as high.

Tables 4.3-5 through 4.3-7 provide a relative likelihood of impact from fuels reduction activities by geomorphic province. Impacts are likely highest for the steep humid to sub-humid portions of the Coast Ranges, Klamath Mountains, Transverse Ranges, Sierra Nevada, and Cascade Range. Highest susceptibility to impacts in these provinces will be in areas with weaker geologic material (Figure 4.3-3). Examples of these types of geologic settings include:

- Young, relatively unconsolidated rocks
  - Colluvium – especially in convergent topography (i.e., hollows)
  - Young sedimentary rock on steep slopes
- Poorly consolidated, sheared, and or clay rich metamorphic rocks (e.g., Franciscan Formation)

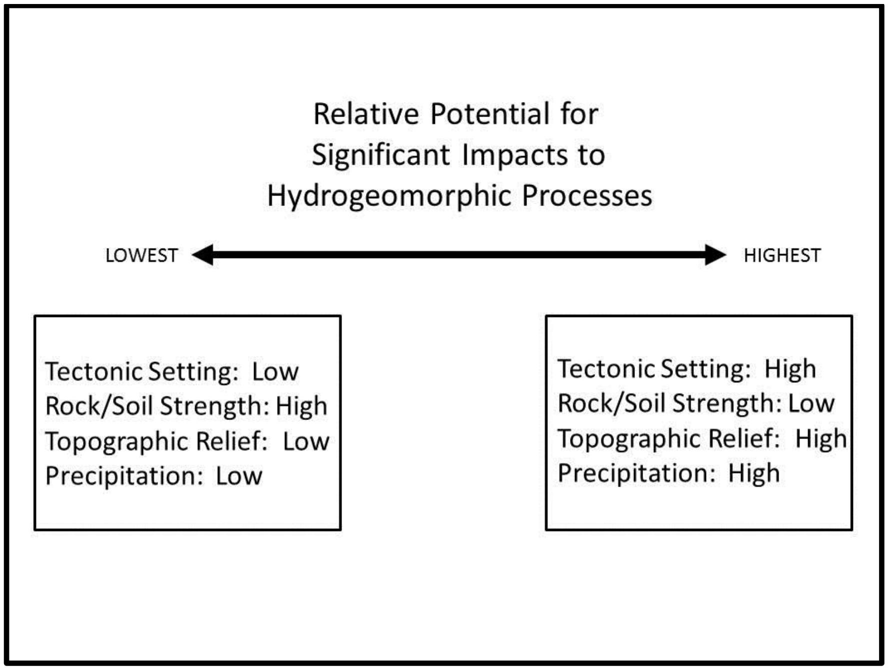
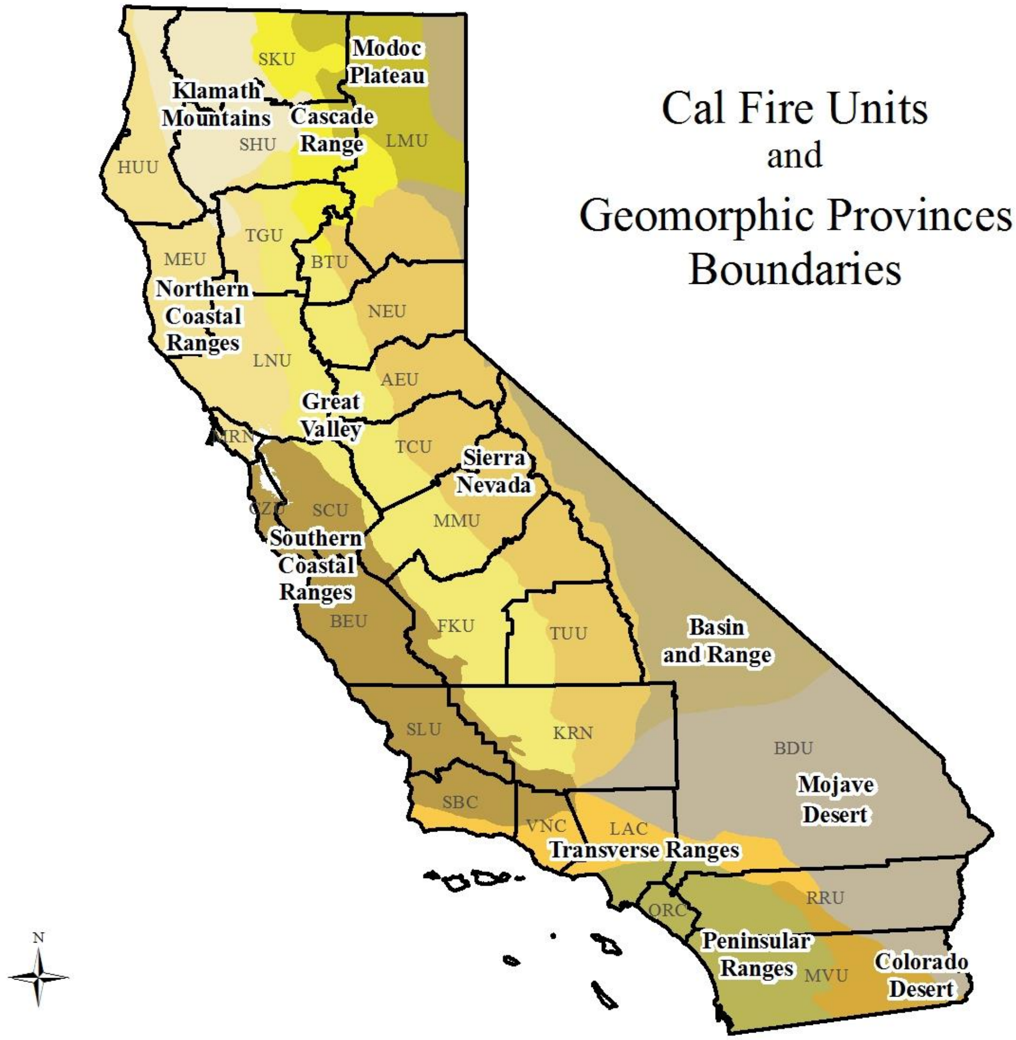


Figure 4.3-4.3-11 The conceptual model detailing the relative risk of significant fuel reduction activities based on a geomorphic province's generalized tectonic setting, rock/soil strength, topographic relief, and precipitation magnitude. (Conceptual model approved by California Geological Survey's Engineering Geologist Chris Gryszan (P.G.) and Senior Engineering Geologist Donald Lindsay (P.G., C.E.G., P.E.)

A moderate relative likelihood of impacts is expected for the Peninsular Ranges, Basin and Range, and Colorado Desert geomorphic provinces. The lowest likelihood of impacts are in Mojave Desert, Modoc Plateau, and Great Valley geomorphic provinces. This is generally due to lower topographic relief, tectonic quiescence, or low precipitation magnitude. Figure 4.3-12 shows where CAL FIRE Units and Contract Counties are located in relation to the geomorphic provinces.



Basin and Range	Cascade Range	Colorado Desert	Great Valley	Klamath Mountains	Modoc Plateau	Mojave Desert	Northern Coastal Ranges	Peninsular Ranges	Sierra Nevada	Southern Coastal Ranges	Transverse Ranges
AEU	SKU	RRU	SHU	HUU	SKU	BDU	HUU	BDU	LMU	FKU	BDU
LMU	LMU	MVU	TGU	SKU	LMU	RRU	SHU	RRU	TGU	MMU	RRU
LMU	SHU		NEU	SHU	SHU	LAC	TGU	ORC	NEU	BEU	SBC
NEU	TGU		LNU	TGU		MVU	MEU	LAC	BDU	SLU	VNC
BDU	BTU		FKU	MEU		KRN	LNU	MVU	FKU	SBC	LAC
KRN			MMU				MRN		MMU	VNC	KRN
			TUU				CZU		TUU	LAC	
			AEU						AEU	CZU	
			TCU						TCU	SCU	
			SCU						KRN	KRN	
			KRN						BTU	SCU	
			BTU								
			SCU								

Figure 4.3-4.3-12 CAL FIRE Units and Contract Counties by Geomorphic Province.

Table 4.3-4.3-8 Relative risk of impacts from fuels reduction activities.

Geomorphic Province	Relative Risk of Impacts
Coast Ranges	High
Klamath Mountains	High
Transverse Ranges	High
Sierra Nevada	High
Cascade Range	High/Moderate
Peninsular Ranges	Moderate
Basin and Range	Moderate
Colorado Desert	Moderate
Mojave Desert	Low
Modoc Plateau	Low
Great Valley	Low

HYDROGEOMORPHIC IMPACTS FROM THE PROGRAM AND ALTERNATIVES

Tables 4.3-5 through 4.3-7 summarize cause-and-effect relationships between likely Program/Alternatives activities and hydrogeomorphic process response. Process-based knowledge of these relationships allow for the crafting of appropriate program and project requirements that prevent significant impacts to geologic, hydrologic, and soil resources. To this end, Tables 4.3-9 through 4.3-11 summarize mitigations for each type of hydrogeomorphic process alteration (i.e., impact type) expected under the Program and Alternatives. These required program elements are assumed to be properly implemented to maximize effectiveness, and the significance of the Program and Alternatives are evaluated in the context of properly implemented SPRs and PSRs.

Table 4.3-9 Examples of SPRs and PSRs for Prescribed Fire and Impact Type. The significance criteria related to each SPR/PSR is indicated in bold.

Prescribed Fire		
Activity	**Impact Type**	**SPRs and PSRs to Minimize/Avoid Impacts**
Pile Burn	Soil disturbance	Limit pile size to less than or equal to 10 feet long and 10 feet wide, or 10 feet in diameter. Limiting pile size will reduce the disturbance footprint of each burn pile.
	Increased runoff	Limit pile size to less than or equal to 10 feet long and 10 feet wide, or 10 feet in diameter. Smaller areas of disturbed soil will produce less runoff at the site scale (i.e., Luce and Black, 1999).
	Increased fluvial erosion	Limit pile size to less than or equal to 10 feet long and 10 feet wide, or 10 feet in diameter. Lower site scale runoff rates will result in less sediment transport capacity for runoff (i.e., Luce and Black, 1999).
Broadcast Burn	Soil disturbance	Burning under an appropriate prescription to initiate a low intensity ground fire that results in low soil burn severity (Robichaud et al., 2010)
	Increased runoff	Burning under an appropriate prescription to initiate a low intensity ground fire that results in low soil burn severity (Robichaud et al., 2010.)
	Increased fluvial erosion	Burning under an appropriate prescription to initiate a low intensity ground fire that results in low soil burn severity (Robichaud et al., 2010).
		Prescription fire will not be ignited in WLPZs; Back firing only. Backing fire has lower flame lengths and will generally result in lower fire severity (Ryan and Noste, 1985)
	Increased mass wasting	Avoid treating unstable areas or areas that can affect unstable areas (CGS, 2013).
		Consult with professional geologist on PSRs that will mitigate against significant project-induced impacts related to unstable areas (CGS, 2013).
		Burning under an appropriate prescription to initiate a low intensity ground fire that results in low soil burn severity. This will minimize runoff production (Troendle et al., 2010) that can trigger landsliding (Neary et al., 1999).

Table 4.3-10 Examples of SPRs and PSRs for Mechanical and Impact Type.

Mechanical, Manual, and Prescribed herbivory		
Activity	**Impact Type**	**SPRs and PSRs to Minimize/Avoid Impacts**
Mechanical	Soil disturbance	No high ground pressure vehicles shall be driven through project areas when soils are wet and saturated to avoid compaction and/or soil damage (Troendle et al., 2010).
		When possible, onsite native vegetative material (e.g. cut material) will be utilized for mulching bare soil (Stednick, 2010).
		Heavy equipment is prohibited on slopes exceeding 65 percent or on slopes greater than 50 percent where the erosion hazard rating is high or extreme. Equipment limitations used in the California Forest Practice Rules.
	Increased runoff	Compacted and/or bare linear treatment areas capable of generating storm runoff will be drained using waterbreaks (MacDonald and Coe, 2008).
		When possible, onsite native vegetative material (e.g. cut material) will be utilized for mulching bare soil. Runoff potential decreases with increased soil cover (Troendle et al., 2010)
	Increased fluvial erosion	No high ground pressure vehicles shall be driven through project areas when soils are wet and saturated to avoid compaction and/or soil damage (Moehring and Rawls, 1970; Page-Dumroese et al., 2010).
		When possible, onsite native vegetative material (e.g. cut material) will be utilized for mulching bare soil (Troendle et al., 2010) .
		Compacted and/or bare linear treatment areas capable of generating storm runoff will be drained using waterbreaks (MacDonald and Coe, 2008).
		Heavy equipment is prohibited on slopes exceeding 65 percent or on slopes greater than 50 percent where the erosion hazard rating is high or extreme. Equipment limitations used in the California Forest Practice Rules.
	Increased mass wasting	Compacted and/or bare linear treatment areas capable of generating storm runoff will be drained using waterbreaks (Montgomery, 1994).
		When possible, onsite native vegetative material (e.g. cut material) will be utilized for mulching bare soil. This will limit runoff production that might increase the likelihood for landslide initiation (Neary et al., 1999).
		No high ground pressure vehicles shall be driven through project areas when soils are wet and saturated to avoid compaction and/or soil damage. Preventing excess runoff will minimize landslide initiation (Reid, 2010).
		Consult with professional geologist on PSRs that will mitigate against significant project-induced impacts related to unstable areas (CGS, 2013).
Manual Hand Treatments	Increased runoff	Compacted and/or bare linear treatment areas capable of generating storm runoff will be drained using waterbreaks (Luce and Black, 1999)
Prescribed herbivory	Soil disturbance	Use fencing, herding, and on-site water will minimize impacts (Trimble and Mendel, 1995; Hubbard et al., 2004).
	Increased runoff	Use fencing, herding, and on-site water will minimize impacts.
	Increased fluvial erosion	Use fencing, herding, and on-site water will minimize impacts.

Table 4.3-11 Examples of SPRs and PSRs for Herbicides and Road activities and impact type.

Herbicides and Roads		
Activity	**Impact Type**	**Example SPRs and PSRs**
Herbicides	See water quality section	See water quality section
Roads	Soil disturbance	No new roads (including temporary roads) may be constructed or reconstructed Existing roads, skid trails, fire lines, fuel breaks, etc that require reopening or maintenance shall have drainage facilities applied at the conclusion of the project that are at least equal to those of the California Forest Practice rules.
		During dry, dusty conditions, unpaved roads shall be wetted using water trucks or treated with a non-toxic chemical dust suppressant (Ziegler et al., 2000).
		Compacted and/or bare linear treatment areas capable of generating storm runoff will be drained using waterbreaks (MacDonald and Coe, 2008).
	Increased runoff	Compacted and/or bare linear treatment areas capable of generating storm runoff will be drained using waterbreaks (MacDonald and Coe, 2008.
	Increased fluvial erosion	No new roads (including temporary roads) may be constructed or reconstructed Existing roads, skid trails, fire lines, fuel breaks, etc that require reopening or maintenance shall have drainage facilities applied at the conclusion of the project that are at least equal to those of the California Forest Practice rules.
	Increased fluvial erosion Increased mass wasting	During dry, dusty conditions, unpaved roads shall be wetted using water trucks or treated with a non-toxic chemical dust suppressant (Ziegler et al., 2000).
		Compacted and/or bare linear treatment areas capable of generating storm runoff will be drained using waterbreaks (MacDonald and Coe, 2008).
	Increased mass wasting	Consult with professional geologist on PSRs that will mitigate against significant project-induced impacts related to unstable areas (CGS, 2013).
		Compacted and/or bare linear treatment areas capable of generating storm runoff will be drained using waterbreaks (Montgomery, 1994).
		No new roads (including temporary roads) may be constructed or reconstructed Existing roads, skid trails, fire lines, fuel breaks, etc that require reopening or maintenance shall have drainage facilities applied at the conclusion of the project that are at least equal to those of the California Forest Practice rules.

Given the discussion above, we know that the highest likelihood for significant adverse hydrogeomorphic impacts will occur with prescribed fire and mechanical treatments in portions of the Coast Ranges, Klamath Mountains, Transverse Ranges, Sierra Nevada, and Cascades dominated by shrub vegetation types. In general, prescribed fire and mechanical treatments will have a higher likelihood for hydrogeomorphic impacts than other fuel reduction activities.

In order to evaluate the potential for significant adverse impacts due to the Program and associated alternatives, it is necessary to determine which fuel reduction activity is most likely given the treatment type (i.e., WUI, fuel breaks, and ecological restoration) and vegetation type. To determine this, we surveyed CAL FIRE Registered Professional Foresters to determine which type of activity was most likely given a specific treatment and vegetation type.

Results from the survey are shown in Table 4.4-6. In general, it shows that relatively more impactful prescribed burning will most likely be highly utilized for ecological restoration treatments in grass vegetation types, will be moderately utilized for fuel break and ecological restoration in forest vegetation, and moderately utilized for fuel break treatments in shrub vegetation. Mechanical treatments will be highly utilized for all treatment types in forest vegetation, and in WUI treatments in shrub vegetation types. Mechanical treatments will be moderately utilized for ecological restoration treatments in shrub vegetation types, and for WUI and fuel break treatments in grass vegetation types.

Table 4.3-12 The relative likelihood of using a fuel reduction activity type based on the desired treatment and dominant vegetation type. Likelihood determined through the averaging of surveyed CAL FIRE Registered Professional Foresters. L=Low likelihood; M=Moderate likelihood; H=High likelihood

Activity	Forest			Shrub			Grass		
Type	WUI	Fuelbreaks	Eco	WUI	Fuelbreaks	Eco	WUI	Fuelbreaks	Eco
Burning	L	M	M	L	M	L	M	M	H
Hand Treatments	H	M	M	M	M	M	L	L	L
Mechanical	H	H	H	H	L	M	M	M	L
Herbicide	M	M	L	L	M	L	L	L	L
Herbivory	L	L	L	L	M	L	L	M	M

The next step in evaluating the potential hydrogeomorphic impacts of the proposed Program and associated alternatives requires knowing which geomorphic provinces the projects will be located under each scenario. Knowing the treatable acreage under each treatment can also help to focus the impact assessment, as the Alternatives are generally comprised of different combinations of the three treatment types. Table 4.3-10 shows the treatable acreage by geomorphic province and treatment type. Tables 4.3-11 through 4.3-13 show the same for tree, shrub, and grass-dominated vegetation types, respectively.

Table 4.3-13 Treatable acreage under the proposed Program by treatment type.

Geomorphic Provinces	WUI	FUEL BREAK	ECO	Total By Geomorphic
Basin and Range	237,577	171,709	233,148	642,433
Cascade Range	600,968	285,833	906,500	1,793,301
Colorado Desert	2,416	64,554	2,464	69,435
Great Valley	1,169,688	494,846	256,355	1,920,889
Klamath Mountains	468,718	199,889	815,965	1,484,571
Modoc Plateau	221,599	173,180	886,064	1,280,843
Mojave Desert	129,988	657,619	18,930	806,537
Northern Coastal Ranges	2,211,588	679,089	2,086,534	4,977,211
Peninsular Ranges	977,028	360,449	251,324	1,588,801
Sierra Nevada	2,733,567	489,494	1,631,164	4,854,224
Southern Coastal Ranges	2,235,626	737,240	1,379,606	4,352,472
Transverse Ranges	735,582	222,336	149,734	1,107,652
Total by Treatment	**11,724,346**	**4,536,236**	**8,617,787**	**24,878,369**

Table 4.3-14 Treatable tree-dominated acres under the proposed Program

Geomorphic Provinces	WUI	FUEL BREAK	ECO	Total By Geomorphic
Basin and Range	43,836	14,961	59,138	117,934
Cascade Range	348,181	191,994	757,462	1,297,638
Colorado Desert	122	999	0	1,121
Great Valley	63,524	17,750	18,323	99,598
Klamath Mountains	378,621	171,562	794,305	1,344,487
Modoc Plateau	108,893	85,702	468,282	662,876
Mojave Desert	22,367	15,489	11,055	48,911
Northern Coastal Ranges	1,393,511	427,121	1,632,836	3,453,468
Peninsular Ranges	55,302	28,922	72,089	156,313
Sierra Nevada	1,472,496	232,047	999,347	2,703,890
Southern Coastal Ranges	266,787	43,892	99,361	410,040
Transverse Ranges	74,431	24,075	25,370	123,875
Total by Treatment	**4,228,070**	**1,254,514**	**4,937,567**	**10,420,152**

Table 4.3-15 Treatable shrub-dominated acres under the proposed Program

Geomorphic Provinces	WUI	FUEL BREAK	ECO	Total By Geomorphic
Basin and Range	186,389	154,256	173,890	514,535
Cascade Range	112,289	40,589	60,152	213,029
Colorado Desert	2,295	63,490	2,464	68,248
Great Valley	30,232	12,221	1,533	43,987
Klamath Mountains	54,250	21,219	9,366	84,835
Modoc Plateau	105,853	83,801	417,341	606,995
Mojave Desert	100,677	634,793	7,869	743,340
Northern Coastal Ranges	187,869	68,489	95,711	352,068
Peninsular Ranges	726,608	280,535	159,242	1,166,385
Sierra Nevada	234,752	57,325	87,051	379,127
Southern Coastal Ranges	399,892	140,973	326,692	867,557
Transverse Ranges	487,418	157,275	90,397	735,090
Total by Veg Type	**2,628,524**	**1,714,965**	**1,431,708**	**5,775,197**

Table 4.3-16 Treatable grass-dominated acres under the proposed Program

Geomorphic Provinces	WUI	FUEL BREAK	ECO	Total By Geomorphic
Basin and Range	7,352	2,492	120	9,964
Cascade Range	140,498	53,250	88,886	282,634
Colorado Desert	0	65	0	65
Great Valley	1,075,932	464,874	236,499	1,777,305
Klamath Mountains	35,847	7,108	12,294	55,249
Modoc Plateau	6,853	3,678	441	10,972
Mojave Desert	6,943	7,337	6	14,286
Northern Coastal Ranges	630,209	183,479	357,987	1,171,675
Peninsular Ranges	195,118	50,992	19,992	266,102
Sierra Nevada	1,026,319	200,122	544,766	1,771,207
Southern Coastal Ranges	1,568,947	552,375	953,553	3,074,875
Transverse Ranges	173,734	40,986	33,967	248,687
Total by Veg Type	**4,867,752**	**1,566,758**	**2,248,511**	**8,683,021**

PROPOSED PROGRAM

Significant effects have a higher likelihood of occurring in geomorphic provinces dominated by shrub vegetation types (i.e., Southern Coast Range, Transverse Ranges, and Peninsular Ranges), since prescribed burning can result in higher burn severity in shrub-dominated vegetation. Moderate to high soil burn severity can increase runoff and erosion rates relative to unburned conditions. Also, mechanical treatments in shrub-dominated vegetation generally have to remove the majority of the vegetation to be effective in fuels reduction. The large number of mechanical treatments in the forested areas of the Coast Ranges, Sierra Nevada, Klamath Mountains and Cascade Range provinces also have a higher potential for significant impacts. This has the potential to decrease soil cover, which is an important control on erosion. The effects analysis requires a Project Scale Analysis, which will identify any locally-detected impacts that may not be detected at the bioregion or province scale.

The Proposed Program proposes to treat 60,000 acres per year in a combination of WUI, Fuel breaks, and Ecological Restoration treatments. By using Tables 4.3-11 through 4.3-13, and assuming that projects will occur in proportion to the area in a given geomorphic province, vegetation type, and treatment type, it is possible to determine how many projects are likely to occur in scenarios with a higher likelihood for impacts. Approximately 21 projects per year have a high likelihood of utilizing burning in grass. The majority of projects utilizing prescribed fire in grass (i.e., ecological restoration) will be in the Coast Ranges geomorphic province, which is projected to have 12 projects of this type per year. There is a moderate likelihood of burning in shrub dominated vegetation for approximately 16 projects per year. Burning in shrub vegetation is projected to be predominantly limited to fuel breaks in the Mojave Desert, Peninsular Ranges, and Coast Ranges provinces. These provinces will account for approximately 6, 3, and 2 projects per year, respectively. Burning in forest vegetation types have a moderate likelihood of occurring in approximately 57 projects per year, with the majority occurring in the Coast Ranges (n=20), the Sierra Nevada (n=11), the Cascade Range (n=9), the Klamath Mountains (n=9), and the Modoc Plateau (n=5). Mechanical treatments have a high likelihood of occurring in 97 projects per year in forest vegetation types, primarily in the Coast Ranges (n=36), Sierra Nevada (n=25), Klamath Mountains (n=13), and Cascade Range (n=12). Projects with a high likelihood of utilizing mechanical activities in shrub vegetation types will be associated with WUI treatments in the Peninsular Ranges (n=7), the Transverse Ranges (n=3), and Coast Ranges (n=2). There is a moderate likelihood that mechanical activities will be used on an additional 13 projects per year for ecological restoration in shrublands, and 60 projects per year in grasslands (i.e., WUI and Fuel breaks treatments).

Several standard project requirements (SPRs) and project specific requirements (PSRs) will reduce impacts to geologic, hydrologic, and soil resources when the Proposed Program is implemented. These SPRs and PSRs are related to individual impact types in Tables 4.3-9 through 4.3-11 and summarized in section 4.3.3. The individual impact types relate back to the significance criteria in Section 4.3.2.1 as following:

- Practices that minimize or avoid soil disturbance relate to Significance Criteria C, E, F, and I.
- Practices that minimize or avoid runoff increases relate to Significance Criteria C, E, F, I, and J.
- Practices that minimize or avoid fluvial erosion relate to Significance Criteria C, E, F, and J.
- Practices that minimize or avoid mass wasting relate to Significance Criteria A, B, I, and J.

Geologic impacts can be minimized to less than significant levels by avoiding unstable areas, or by developing PSRs in consultation with a Professional Geologist/Certified Engineering Geologist (GEO-1). The most important requirement for minimizing effects due to prescribed fire is to utilize prescribed fire under the appropriate prescription to minimize soil burn severity and associated hydrogeomorphic impacts associated with moderate to high soil burn severity (GEO-2, FBE-1 through FBE-3, and HYD-4). For mechanical treatments, erosion control requirements will be utilized to prevent runoff concentration (HYD-5 through HYD-9, HYD-13 through HYD-16). Although addressed in more detail Section 4.5 (Water Quality), watercourse and lake protection zones (WLPZs) will be required to buffer against project-induced increases in runoff and/or erosion. Fuel reduction activities will result in **less than significant impacts** once SPRs and PSRs are implemented.

ALTERNATIVES

The “No Project” alternative is expected to have fewer impacts than the Proposed Program. This is primarily because the project acreage under this alternative is less than half of that under the proposed program (i.e., 27,000 acres per year; 104 projects per year). On a unit acre basis, the “No Project” alternative might be more impactful due to the fact that there are fewer best management practices than those offered by the Proposed Program. Historically, the VMP relied on burning for 50 percent of its treatments, and burning is generally more impactful than most other forms of fuel reduction activities. However, fewer treated acres will generally result in fewer potential impacts. **The No Project alternative would result in no significant impacts to geologic, hydrologic, or soil resources.**

Alternative A treats 60,000 acres per year solely in the WUI treatment type. This alternative will more than double the number of projects in the WUI from 108 projects per year, to 231 projects per year. The same SPRs and PSRs will be utilized as in the Proposed Program. In general, WUI treatments will seldom utilize prescribed burning in shrub and forest dominated vegetation and will place an increased emphasis on mechanical and hand treatments in these areas. As such, fewer impacts from prescribed fire will occur using this alternative, but impacts from mechanical activities will increase. It is expected that impacts from Alternative A will be slightly less than those in the Proposed Program, despite the same amount of area being treated. **Alternative A would result in no significant impacts to geologic, hydrologic, or soil resources.**

Alternative B treats 60,000 acres per year between the WUI and fuel breaks treatment type. Projects in the WUI are projected to be 36 percent higher than the Proposed Program (n=147), and projects utilizing fuel breaks treatments are expected to increase by 80 percent relative to the Proposed Program. Burning for fuel breaks treatments in shrub dominated areas is expected to rise by 50 percent, and in general the use of mechanized fuel reduction activities will increase due to the increased focus on WUI and fuel breaks. It is expected that impacts from Alternative B will be comparable to those projected from the Proposed Program, with a slight increase in impacts to shrub dominated areas subjected to fuel breaks treatments. **Alternative B would result in no significant impacts to geologic, hydrologic, or soil resources.**

Alternative C treats 60,000 acres per year in Very High Fire Hazard Severity Zones (VHFHSZ) only. This alternative utilizes all fuel reduction activities to achieve fuel hazard reduction. While this alternative treats the same acreage annually as the Proposed Program, Alternative A, and Alternative B, the distribution of VHFHSZ is more dispersed in nature. Dispersing activities will theoretically lessen impacts to geologic, hydrologic, and soil resources. As such, this alternative will have slightly less impact than the Proposed Program. **Alternative C would result in no significant impacts to geologic, hydrologic, or soil resources.**

Alternative D treats 36,000 acres per year but limits prescribed fire to only 6,000 acres annually. As such, this alternative would rely on mechanical, herbicide, hand treatment, and herbivory activities to implement WUI, fuel break, and ecological restoration treatments. The scale of this alternative is smaller than Alternatives A, B, or C, and therefore the potential for significant impacts is the lowest of any alternative other than the “no project” alternative. **Alternative D would result in no significant impacts to geologic, hydrologic, or soil resources.**

4.3.3 MITIGATION AND STANDARD PROJECT REQUIREMENTS

Under this analysis there are no mitigations. However, several Standard Project Requirements have been developed as part of the project design. Table 4.3-13 shows example SPRs and PSRs related to each type of geologic, hydrologic, or soil-related impact previously discussed in Table 4.3-5.

Geologic Standard Project Requirements:

GEO-1: An RPF or licensed geologist shall assess the project area for unstable areas and unstable soils as per 14 Section CCR 895.1 of the California Forest Practice Rules.

Guidance on identifying unstable areas is contained in the California Licensed Foresters Association *Guide to Determining the Need for Input From a Licensed Geologist During THP Preparation* and California Geological Survey (CGS) Note 50 (see Appendix C). Priority will be placed on assessing watercourse-adjacent slopes greater than 50%. If unstable areas or soils are identified within the project area, are unavoidable, and are potentially directly or indirectly affected by the project operations, a licensed geologist (P.G. or C.E.G.) shall conduct a geologic assessment to determine the potential for project-induced impacts and mitigation strategies. Project shall incorporate all of the recommended mitigations. Geologic reports should cover the topics outlined in CGS Note 45 (see Appendix C).

GEO-2: The potential impacts of prescribed fire on geologic processes shall be reduced by following the Fire Behavior-related SPRs FBE-1, FBE-2, and FBE-3.

4.3.3.1 **Hydrologic and Water Quality-Related Standard Project Requirements**

HYD-1: The project shall comply with all applicable water quality requirements adopted by the appropriate Regional Water Quality Control Board and approved by the State Water Board (i.e., Basin Plan).

HYD-2: During the planning phase the project coordinator shall submit a standard letter to the appropriate RWQCB containing the following:

- A written description of the project location and boundaries
- Brief narrative of the project objectives
- A description of the types of activities used in the project (e.g., prescribed burning, mastication) and associated acreages
- A project and general location map. Project map shall be of sufficient scale to indicate the spatial extent of activities within the project area
- Notification of whether the project drains directly into an impaired water body, and the type of water quality constituent(s) that is impairing the water body.
- A request for information and recommendations regarding the potential for significant water quality impacts from the proposed project and an offer to schedule a day to visit the project area with the project coordinator. The project shall incorporate the recommendations that prevent significant impacts to water quality as PSRs.

HYD-3: A WLPZ shall be established on each side of all Class I and II watercourses that is equal to the standard widths specified in the current CA Forest Practice Rules (Table 4.2-38). Fifty foot equipment limitation zones (ELZs) shall be established for Class III watercourses. Vegetation within the WLPZ or ELZ will not be disturbed by project activities, with the exception of backing prescribed fire. Class IV watercourse protections shall be PSRs specified in the PSA, and designed in conjunction with any recommendations from RWQCB staff.

Table 4.3-17 Watercourse and lake protection zone buffer widths by watercourse classification and hill slope gradient (See HYD -3)

Note: ELZ-Equipment Limitation Zone, PSR-Project Specific Requirement

Water Class Characteristics or Key Indicator / Beneficial Use	1)Domestic supplies, including springs, on site and/or within 100 feet downstream of the project area and/or 2) Fish always or seasonally present onsite, includes habitat to sustain fish migration and spawning	1) Fish always or seasonally present offsite within 1000 feet downstream and/or 2) Aquatic habitat for non-fish aquatic species. 3) Excludes Class III water that are tributary to Class I waters	No aquatic life present, watercourse showing evidence of being capable of sediment transport to Class I and II water under normal high water flow conditions of timber operations	Man-made watercourses, usually downstream, established domestic, agricultural, hydroelectric supply or other beneficial use
Water Class	Class I	Class II	Class III	Class IV
Slope Class (%)	Width (ft.)	Width (ft.)	Width (ft.)	Width
<30	75	50	50 (ELZ)	PSR
30-50	100	75	50 (ELZ)	PSR
>50	150	100	50 (ELZ)	PSR

HYD-4: No direct ignition shall be allowed within the WLPZ or ELZs. However, it is acceptable for a fire to enter or back into a WLPZ's or ELZ's.

HYD-5: Compacted and/or bare linear treatment areas (e.g., fire breaks, roads, or trails) capable of generating storm runoff shall be drained via water breaks using the spacing guidelines contained in CCR Sections 914.6, 934.6, and 954.6 (c) of the California Forest Practice Rules.

HYD-6: Compacted and/or bare treatment areas shall be drained such that they are hydrologically disconnected from watercourses or lakes. Measures to hydrologically disconnect these areas shall be guided by consulting with Technical Rule Addendum #5 of the California Forest Practice Rules – Guidance on Hydrologic Disconnection, Road Drainage, Minimization of Diversion Potential, and High Risk Crossings

HYD-7: No high ground pressure vehicles shall be driven through project areas when soils are wet and saturated to avoid compaction and/or damage to soil structure.

Saturated soil means that soil and/or surface material pore spaces are filled with water to such an extent that runoff is likely to occur. Indicators of saturated soil conditions may include, but are not limited to: (1) areas of ponded water, (2) pumping of fines from the soil or road surfacing material during timber operations, (3) loss of bearing strength resulting in the deflection of soil or road surfaces under a load, such as the creation of wheel ruts, (4) spinning or churning of wheels or tracks that produces a wet slurry, or (5) inadequate traction without blading wet soil or surfacing materials.

HYD-8: When possible, bare soil will be mulched with onsite native vegetative material (e.g., cut material).

HYD-9: During dry, dusty conditions, unpaved roads shall be wetted using water trucks or treated with a non-toxic chemical dust suppressant (e.g., emulsion polymers, organic material). Any dust suppressant product used shall be environmentally benign (i.e., non-toxic to plants and shall not negatively impact water quality) and its use shall not be prohibited by the ARB, U.S. Environmental Protection Agency (EPA), or the State Water Resources Control Board. Exposed areas shall not be over-watered such that water results in runoff. The type of dust suppression method shall be selected by the contractor based on soil, traffic, site-specific conditions, and local air quality regulations.

HYD-10: Prior to the start of onsite activities, all equipment will be inspected for leaks and regularly inspected thereafter until equipment is removed from the project area. All contaminated water, sludge, spill residue, or other hazardous compounds will be contained and disposed of outside the boundaries of the site, at a lawfully permitted or authorized destination.

HYD-11: Staging areas shall be designated and located to prevent leakage of oil, hydraulic fluids, or other chemicals into watercourses or lakes.

HYD-12: All heavy equipment parking, refueling, and service shall be conducted within designated areas outside of the WLPZ or ELZ.

HYD-13: No new roads (including temporary roads) shall be constructed or reconstructed (reconstruction is defined as cutting or filling involving less than50 cubic yards/0.25 linear road miles). Existing roads, skid trails, fire lines, fuel breaks, etc. that require reopening or maintenance shall have drainage facilities applied at the conclusion of the project that are at least equal to those of the California Forest Practice Rules.

HYD-14: Heavy equipment is prohibited on slopes exceeding 65 percent or on slopes greater than 50 percent where the erosion hazard rating is high or extreme. Heavy equipment is prohibited on slopes greater than 50 percent that lead without flattening to watercourses.

HYD-15: Burn piles shall not exceed 10 feet in length, width, or diameter, except when on landings or road surfaces.

HYD-16: At the Calwater Planning Watershed scale, if the combined acreage subjected to mechanical fuel treatments, prescribed fire, and logging exceed 20% of the watershed area within a 10-year timespan, an analysis will be performed to determine the potential for hydrologically-induced significant impacts of the proposed activity.

HYD-17: If herbivory is proposed to treat vegetation in a project area containing watercourses, then the following items must be addressed as PSRs:

- The project will require water on site in the form of an on-site stock pond outside the WLPZ or ELZ, or a portable water source located outside the WLPZ or ELZ.
- The project will specify animal containment measures in the PSA to prevent animals from entering the WLPZ and/or ELZs. These might include the use of fencing (i.e., fixed or portable), the use of guard or herd dogs, or the use of an on-site herder.

4.4 HAZARDOUS MATERIALS, PUBLIC HEALTH AND SAFETY

This section evaluates the potential environmental impacts related to hazardous materials, public health, and safety, which could result as a consequence of implementation of the VTP. This section presents the environmental setting and potential impacts of the vegetation treatment activities related to hazards and hazardous materials. This section incorporates the pesticide background Information gathered for this program (Appendix D).

4.4.1 AFFECTED ENVIRONMENT

4.4.1.1 Regulatory Framework

4.4.1.1.1 Federal

FEDERAL INSECTICIDE, FUNGICIDE, AND RODENTICIDES ACT

The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) provides the basis for regulation, sale, distribution, and use of pesticides in the United States. The FIFRA authorizes the U.S. Environmental Protection Agency (EPA) to review and register pesticides for specified uses. EPA also has the authority to suspend or cancel the registration of a pesticide if subsequent information shows that continued use would pose unreasonable risks. Some key elements of FIFRA include:

- is a product licensing statute; pesticide products must obtain an EPA registration before manufacture, transport, and sale;
- registration based on a risk/benefit standard;
- strong authority to require data--authority to issue Data Call-ins;
- ability to regulate pesticide use through labeling, packaging, composition, and disposal;
- emergency exemption authority--permits approval of unregistered uses of registered products on a time limited basis; and
- Ability to suspend or cancel a product's registration: appeals process, adjudicatory functions, etc.

FIFRA has been amended by the Pesticide Registration Improvement Act of 2003, which provides for the enhanced review of covered pesticide products, to authorize fees for certain pesticide products, and to extend and improve the collection of maintenance fees.

SAFE DRINKING WATER ACT OF 1974

Under the Safe Drinking Water Act of 1974, the EPA establishes maximum contaminant levels (MCLs), which are specific concentrations that cannot be exceeded for a given contaminant in surface water or groundwater. EPA has the ability to enforce these nationwide standards or delegate administration and enforcement duties to state agencies. The California Department of Public Health (CDPH) administers the federal Safe Drinking Water Act in California.

OCCUPATIONAL HEALTH AND SAFETY ADMINISTRATION

Enacted in 1970, the Occupational Safety and Health Act established this administration to ensure healthy working conditions in the United States. There are approximately 2,100 Occupational Health and Safety Administration (OSHA) inspectors, who along with other experts and support staff, establish and enforce protective standards in the workplace. California, under an agreement with OSHA, operates an occupational safety and health program in accordance with Section 18 of the Occupational Safety and Health Act of 1970. The program applies to all public and private sector places of employment in the State, with the exception of federal employees, the U.S. Postal Service, private sector employers on Native American lands, maritime activities on the navigable waterways of the United States, private contractors working on land designated as exclusive Federal jurisdiction, and employers that require Federal security clearances.

U.S. EPA

EPA oversees pesticide use through the Worker Protection Standard (WPS). The WPS is a regulation for agricultural pesticides which is aimed at reducing the risk of pesticide poisonings and injuries among agricultural workers and pesticide handlers. The WPS protects employees on farms, forests, nurseries, and greenhouses from occupational exposure to agricultural pesticides. The regulation covers two types of workers:

- Pesticide handlers -- those who mix, load, or apply agricultural pesticides; clean or repair pesticide application equipment; or assist with the application of pesticides in any way.
- Agricultural workers -- those who perform tasks related to the cultivation and harvesting of plants on farms or in greenhouses, nurseries, or forests. Workers include anyone employed for any type of compensation (including self-employed) doing tasks -- such as carrying nursery stock, repotting plants, or watering -- related to the production of agricultural plants on an agricultural establishment. Workers do not include office employees, truck drivers, mechanics, and any others not engaged in handling, cultivation, or harvesting activities.

The WPS contains requirements for pesticide safety training, notification of pesticide applications, use of personal protective equipment, restricted-entry intervals after pesticide application, decontamination supplies, and emergency medical assistance.

U.S. DEPARTMENT OF TRANSPORTATION

The U.S. Department of Transportation, in conjunction with EPA, is responsible for enforcement and implementation of federal laws and regulations pertaining to transportation of hazardous materials. The Hazardous Materials Transportation Act of 1974 (49 U.S. Code 5101 et seq.) directs the U.S. Department of Transportation to establish criteria and regulations regarding safe storage and transportation of hazardous materials. Hazardous materials regulations are contained in 49 Code of Federal Regulations (CFR) 171–180, and address transportation of hazardous materials, types of materials defined as hazardous, and the marking of vehicles transporting hazardous materials. In particular, 49 CFR 173, titled “Shippers’ General Requirements for Shipments and Packaging,” defines hazardous materials for transportation purposes; within this portion of the code, 49 CFR 173.3 provides specific packaging requirements for shipment of hazardous materials, and 49 CFR 173.21 lists categories of materials and packages that are forbidden for shipping. 49 CFR 177, titled “Carriage by Public Highway,” defines unacceptable hazardous materials shipments.

4.4.1.1.2 State

California’s programs for the registration of pesticides and commercial chemicals parallel federal programs, but many of California’s requirements are stricter than federal requirements. The California Environmental Protection Agency (Cal/EPA) regulates registration of pesticides and commercial chemicals in California. Within Cal/EPA, the California Department of Pesticide Regulations (CDPR) oversees pesticide evaluation and registration through use enforcement, environmental monitoring, residue testing, and reevaluation. The CDPR works with County Agricultural Commissioners, who evaluate, develop conditions of use, approve, or deny permits for restricted-use pesticides; certify private applicators; conduct compliance inspections; and take formal compliance or enforcement actions.

California also requires commercial growers and pesticide applicators to report commercial pesticide applications to local county agricultural commissioners. The CDPR compiles this information in annual pesticide use reports. CDPR’s Environmental Hazards Assessment Program collects and analyzes environmental pesticide residues, characterizes drift and other off-site pesticide movement, and evaluates the effect of application methods on movement of pesticides in air. If a pesticide is determined to be a toxic air contaminant, appropriate control measures are developed with the California Air Resources Board to reduce emissions to levels that adequately protect public health. Control measures may include product label amendments, applicator training, restrictions on use patterns or locations, and product cancellations.

SAFE DRINKING WATER ACT 1976

CDPH administers the federal Safe Drinking Water Act in California. In addition to enforcing the primary MCLs, CDPH uses as guidelines Secondary MCLs that regulate constituents that affect water quality aesthetics (such as taste, odor, or color). Additionally, under the California Safe Drinking Water Act, Cal/EPA’s Office of Environmental Health Hazard Assessment develops Public Health Goals (PHGs) for contaminants in California’s publicly supplied drinking water. PHGs are concentrations of drinking water contaminants that pose no significant health risk if consumed for a lifetime, based on current risk assessment principles, practices, and methods. Public water systems use PHGs to provide information about drinking water contaminants in their annual Consumer Confidence Reports.

THE SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT

This Safe Drinking Water and Toxic Enforcement Act (Proposition 65), passed as a ballot initiative in 1986, requires the state to annually publish a list of chemicals known to the state to cause cancer or reproductive toxicity so that the public and workers are informed about exposures to potentially harmful compounds. Cal/EPA's Office of Environmental Health Hazard Assessment administers the act and evaluates additions of new substances to the list. Proposition 65 requires companies to notify the public about chemicals in the products they sell or release into the environment, such as through warning labels on products or signs in affected areas, and prohibits them from knowingly releasing significant amounts of listed chemicals into drinking water sources.

CALIFORNIA PESTICIDE REGULATORY PROGRAM

CDPR regulates the sale and use of pesticides in California. CDPR is responsible for reviewing the toxic effects of pesticide formulations and determining whether a pesticide is suitable for use in California through a registration process. Although CDPR cannot require manufacturers to make changes in labels, it can refuse to register products in California unless manufacturers address unmitigated hazards by amending the pesticide label. Consequently, many pesticide labels that are already approved by the EPA also contain California-specific requirements. Pesticide labels defining the registered applications and uses of a chemical are mandated by EPA as a condition of registration. The label includes instructions telling users how to make sure the product is applied only to intended target pests, and includes precautions the applicator should take to protect human health and the environment. For example, product labels may contain such measures as restrictions in certain land uses and weather (i.e., wind speed) parameters.

CALIFORNIA DEPARTMENT OF FORESTRY AND FIRE PROTECTION

Public Resources Code 4201-4204 directs California Department of Forestry and Fire Protection (CAL FIRE) to map fire hazards within State Responsibility Areas based on relevant factors such as fuels, terrain, and weather. These statutes were passed after significant WUI fires occurred; consequently, these hazards are described according to their potential for causing ignitions to buildings. These zones, referred to as Fire Hazard Severity Zones, provide the basis for application of various mitigation strategies to reduce risks to buildings associated with wildland fires (CAL FIRE 2007). Additionally, the Public Resources Code, beginning with Section 4427, includes fire safety regulations that restrict the use of equipment that may produce a spark, flame, or fire;

require the use of spark arrestors on construction equipment with internal combustion engines; specify requirements for the safe use of gasoline-powered tools in fire hazard areas; and specify fire suppression equipment that must be provided on site for various types of work in fire-prone areas. These requirements would apply to VTP activities within a “Very High Fire Hazard Severity Zone.”

CALIFORNIA DEPARTMENT OF TOXIC SUBSTANCES CONTROL

The California Department of Toxic Substances Control (DTSC), a division of Cal/EPA, has primary regulatory responsibility over hazardous materials in California, working in conjunction with the federal EPA to enforce and implement hazardous materials laws and regulations. DTSC can delegate enforcement responsibilities to local jurisdictions.

The hazardous waste management program enforced by DTSC was created by the Hazardous Waste Control Act (California Health and Safety Code Section 25100 et seq.), which is implemented by regulations described in CCR Title 26. The State program thus created is similar to, but more stringent than, the federal program under RCRA. The regulations list materials that may be hazardous and establish criteria for their identification, packaging, and disposal.

Environmental health standards for management of hazardous waste are contained in CCR Title 22, Division 4.5. In addition, as required by California Government Code Section 65962.5, DTSC maintains a Hazardous Waste and Substances Site List for the state, commonly called the Cortese List. Lands within the project area are included on this list (DTSC 2015).

California’s Secretary for Environmental Protection has established a unified hazardous waste and hazardous materials management regulatory program (Unified Program) as required by Senate Bill 1082 (1993). The Unified Program consolidates, coordinates, and makes consistent the administrative requirements, permits, inspections, and enforcement activities for the following environmental programs:

- hazardous waste generator and hazardous waste onsite treatment programs;
- Underground Storage Tank program;
- hazardous materials release response plans and inventories;
- California Accidental Release Prevention Program;
- Aboveground Petroleum Storage Act requirements for spill prevention, control, and countermeasure plans; and
- California Uniform Fire Code hazardous material management plans and inventories.

The six environmental programs within the Unified Program are implemented at the local level by local agencies—Certified Unified Program Agencies (CUPAs). CUPAs carry out the responsibilities previously handled by approximately 1,300 State and local agencies, providing a central permitting and regulatory agency for permits, reporting, and compliance enforcement.

CALIFORNIA DEPARTMENT OF INDUSTRIAL RELATIONS, DIVISION OF OCCUPATIONAL HEALTH AND SAFETY ADMINISTRATION

The California Department of Industrial Relations, Division of Occupational Safety and Health Administration (Cal/OSHA), assumes primary responsibility for developing and enforcing workplace safety regulations within the state. Cal/OSHA standards are more stringent than federal OSHA regulations, and are presented in CCR Title 8. Standards for workers dealing with hazardous materials include practices for all industries (General Industry Safety Orders); specific practices are described for construction, and hazardous waste operations and emergency response. Cal/OSHA conducts on-site evaluations and issues notices of violation to enforce necessary improvements to health and safety practices.

CALIFORNIA OFFICE OF EMERGENCY SERVICES

The California Office of Emergency Services (OES) issued the State of California Multi-Hazard Mitigation Plan (Multi-Hazard Mitigation Plan) (California OES 2013) in 2013. The federal Disaster Mitigation Act required all state emergency services agencies to issue such plans, for the states to receive federal grant funds for disaster assistance and mitigation under the Stafford Act (44 CFR 201.4). The overall intent of the Multi-Hazard Mitigation Plan is to reduce or prevent injury and damage from natural hazards in California, such as earthquakes, wildfires, and flooding. The plan identifies past and present hazard mitigation activities, current policies and programs, and mitigation goals, objectives, and strategies for the future.

CALIFORNIA AIR RESOURCES BOARD

California Air Resources Board (ARB) oversees California's Smoke Management Program, which addresses potentially harmful smoke impacts from agricultural, forest, and range land management burning operations. The legal basis of the program is found in the *Title 17 Smoke Management Guidelines for Agricultural and Prescribed Burning,* adopted by ARB on March 23, 2000 (ARB 2011). The Guidelines state that each air district or region shall adopt, implement, and enforce a smoke management program, in coordination with ARB and other appropriate stakeholders. ARB has authority to approve these smoke management programs. Elements of the program include permitting requirements for agricultural and prescribed burns, meteorological and smoke management forecasting, and a daily burn authorization system (ARB 2000). The *California Wildfire Smoke Response Coordination*, prepared under the auspices of ARB's California Air Response Planning Agency (CARPA) and the California Interagency and Smoke Council, provides useful information and resources seeking assistance in protecting the public's health from the impacts of smoke during catastrophic fires (CARPA 2015). This program is discussed in more detail in Section 4.12, Air Quality, of this document.

4.4.1.2 **Environmental Setting**

CAL FIRE is dedicated to the fire protection and stewardship of over 31 million acres of California's privately-owned wildlands that make up a variety of habitats rich in both numbers and variety of plants and animals. In addition, the Department provides varied emergency services in 36 of the State's 58 counties via contracts with local governments. The Department's firefighters, fire engines, and aircraft respond to an average of more than 5,600 wildland fires each year. Those fires burn more than 172,000 acres annually. CAL FIRE's mission emphasizes the management and protection of California's natural resources; a goal that is accomplished through ongoing assessment and study of the State's natural resources and an extensive CAL FIRE Resource Management Program (CAL FIRE 2012a).

CAL FIRE works to protect a variety of habitats rich in both numbers and variety of plants and animals. The SRA includes 12 bioregions and a number of vegetation subtypes (i.e., grassland, desert brush land, general brush land, hardwood, and long and –short needled conifer). Common visitors of SRA land include nearby residents and recreational users. Many SRAs are immediately adjacent to public use, residential, and active agricultural areas (see Figures 4.1-2 through 4.1-4 in Section 4.1 of this document).

The proposed VTP could be implemented within 24 million acres or 78 percent of SRA land in California (see Section 2.5, Table 2.5.1, of this document). Approximately 50 percent of this acreage is within the proposed WUI treatment type, with the majority of the WUI acreage occurring in the Sierra Nevada and Klamath/North Coast bioregions, respectively. Ecological restoration accounts for approximately 36 percent of the available acreage; with most of the acreage occurring in the Klamath/North Coast, Modoc, and Sierra Nevada bioregions, respectively. Fuel breaks make up the smallest proportion of the treatments, accounting for only 14 percent of the area available for treatment.

4.4.1.3 **Hazardous Materials**

California Health and Safety Code (Section 25501) defines “hazardous materials” as any material that, because of its quantity, concentration, or physical or chemical characteristics, poses a significant present or potential hazard to human health and safety or to the environment if released into the workplace or the environment. “Hazardous materials” include, but are not limited to, hazardous substances, hazardous waste, and any material that a handler or the administering agency has a reasonable basis for believing that it would be injurious to the health and safety of persons or harmful to the environment if released into the workplace or the environment.

Soil contamination generally occurs in areas that are or have been previously developed, especially with industrial-type uses. Soil contamination can also occur in areas where pesticides have been historically applied, as well as in areas that have historically been mined. Contamination is also sometimes associated with leaking utilities (i.e., leaking petroleum or gas pipelines, or leaking transformers on utility poles), or accidental spills. For the most part, treatment sites within the SRA are not located on previously developed land, but would primarily be located in grasslands, wildlands, and undeveloped areas near urban developed areas (i.e., WUI areas). Although limited, some treatment areas may contain remnant contamination from previous agricultural uses, may have been affected by contamination from nearby urban areas, or may have been exposed to leaks from pipelines and/or transformers and utility poles.

4.4.1.3.1 Wildland Fire Hazards

Wildland fires are seasonally common in certain forests, woodlands, grasslands, chaparral, and other high-fuel areas. SRA lands are located in many areas considered to have high wildland fire risk. CAL FIRE designates SRA land into moderate, high, and very high fire hazard severity zones. These zones are based on local vegetation type (fuel loading), slope, and weather. Fires are an integral part of the natural world, but historic human alteration of natural fire cycles has allowed unnatural plant succession and fire fuel build-up. CAL FIRE currently employs fire fuel management practices in the SRA, where wildfire hazards are present, to minimize and manage the potential risk. CAL FIRE also has the primary responsibility for wildland fire response in many State Park units. In areas closer to communities, mutual aid agreements also exist with local fire protection agencies. Fire hazard severity zones are depicted in Figure 4.1-1 of this document.

4.4.1.3.2 User Groups and Sensitive Receptors

User groups and sensitive receptors near and within SRA lands include: recreational users, residents, private landowners, and schools. Generally, visitors to SRA lands use the land for recreational activities (i.e., hiking, biking, off-road motor vehicles, horseback riding, etc.). CAL FIRE manages eight Demonstration State Forests covering over 71,000 acres. CAL FIRE does not have jurisdiction over campgrounds in California, however, camping is allowed on some of the CAL FIRE Demonstration State Forests sites (CAL FIRE 2012b).

4.4.2 EFFECTS

4.4.2.1 Significance Criteria

Based on Appendix G of the State CEQA Guidelines, a hazards and hazardous material impact is considered significant if implementation of the project would do any of the following:

- create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials;
- create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment;
- emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school;
- be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, create a significant hazard to the public or the environment;
- result in a safety hazard associated with private airstrips or airports;
- impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan; or
- expose people or structures to a significant risk of loss, injury, or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands, or otherwise increase the risks of fire damage to these areas.

THRESHOLDS

The thresholds used in this analysis are based on the CEQA significance criteria identified above. Thus for this analysis, implementation of the vegetation treatment activities under the VTP would result in significant hazards and hazardous materials related impacts if projects were to:

1. Expose the public or the environment to hazardous materials; or
2. Expose people to existing hazardous material or soil contamination; or
3. Create public hazards related to smoke from prescribed burns; or
4. Increase the risk of wildland fire hazards.

4.4.2.2 Impact Analysis Methods

Analysis of impacts related to hazards and hazardous materials involves describing existing conditions and current practices related to vegetation treatment activities for handling, storage, and disposal of hazardous materials, and, considering any impact reductions from implementation of applicable Standard Project Requirements (SPRs), evaluating any changes in those practices. Federal, state, and local agencies would be expected to continue to enforce applicable requirements to the extent that they do so now. In determining the level of significance of potential impacts, the analysis assumes that implementation of the VTP would comply with relevant federal, state, and local ordinances and regulations. As described in Chapter 2, Program Description, SPRs have been developed to implement the VTP. Applicable SPRs are incorporated into the impact statements below, and considered for determination of significance conclusions of environmental impacts.

4.4.2.3 Impact Analysis

ISSUES OR POTENTIAL IMPACTS NOT DISCUSSED FURTHER

Implementation of the VTP would not alter roadways or other potential emergency evacuation routes and plans as no permanent alterations to the land would occur. Rather, the project would implement measures to maintain the integrity and accessibility of fire access roads and other access points. While there may be temporary disruptions to some access points when vegetation treatment activities are being implemented, these disruptions would be implemented for the protection of the public during treatment (e.g., prescribed fire burns) and the access would be reinstated once the project is complete. Thus, the VTP would not have any substantial and adverse impacts on adopted emergency response or emergency evacuation plans. This issue is not discussed further in this EIR.

While it is likely that some VTP activities may occur within two miles of an airport, activities proposed under the VTP do not include development of structures or facilities. Therefore, the project would not result in the construction of facilities that would interfere with aircraft flight patterns or air traffic control communications, and not pose a safety hazard for people residing or working within the area. Activities associated with the manual, mechanical, and chemical treatments would not be performed within airport lands, and would not violate structural height standards associated with airport land use requirements. This issue is not discussed further in this EIR. With regards to smoke emissions from prescribed fires and the potential to create safety hazards associated with lower visibility, this issue is discussed further below in Impact 3. Potential respiratory effects of smoke resulting from prescribed burns are analyzed in Section 4.12, Air Quality, of this document.

Schools may be located in close proximity to SRA lands suitable for VTP activities. While children are considered to be of greater sensitivity to hazards and hazardous materials than adults, the relative effects of implementing treatments under the VTP are considered inclusive in the impact analysis below. No substantial differences between the effects on schools compared to the general public are anticipated. Thus, impacts associated with schools are not discussed further in this EIR.

IMPACT 1: EXPOSE THE PUBLIC OR ENVIRONMENT TO HAZARDOUS MATERIALS.

Use of Hazardous Materials

Prescribed fire, hand treatments, mechanical treatments, prescribed herbivory, and chemical treatments associated with the VTP would result in activities that could require the transportation, use, and storage of various pesticides (see Table 4.4-1) and other hazardous materials (e.g., common household hazardous materials such as fuels, oils, lubricants, solvents, and detergents; retardants, foams, and water enhancers to control an escaped prescribed fire). Treatment activities under the VTP would primarily utilize mechanical equipment, which typically does not include routine use of hazardous materials with the exception of small quantities of common household hazardous materials such as fuels, oils, lubricants, solvents, and detergents. CAL FIRE staff would continue to use, transport, store, and dispose of any hazardous materials consistent with OSHA and EPA regulations. As required under state and federal law, plans for notification and evacuation of site workers and local residents in the event of a hazardous materials release would be in place throughout implementation of VTP activities.

Targeted application of herbicides would make up 10 percent of activities under the VTP. Implementation of SPRs HAZ-2 through HAZ-13 would require proper application of herbicides and would minimize the potential for unwanted adverse impacts to non-target species (i.e., aquatic habitat and habitat for listed species). Treatment activities associated with the VTP would result in activities that could require the transportation, use, and storage of various pesticides and other hazardous materials. Existing measures and regulatory requirements currently in place to address spills and accidents would be sufficient for the VTP such that the project would not result in adverse exposure conditions to hazardous materials. CAL FIRE complies with all relevant regulatory requirements pertaining to the handling of hazardous materials including pesticides. Further, SPRs HAZ-2, HAZ-3, HAZ-4, HAZ-5, HAZ-7 through HAZ-13 require several measures to prevent accidental leaks, spills, or other emissions of hazardous materials into the environment including, a Spill Prevention Plan, and a Materials Management Plan, proper handling of herbicides and other chemicals, and minimizing the potential for unwanted adverse impacts to non-target species (i.e., humans, animals, and special-status species) Thus, VTP treatments that would require the transportation, use, and storage of hazardous materials associated with the VTP would not result in the exposure of the public or environment to adverse conditions associated with the use of these materials. Further, CAL FIRE would implement SPRs for each treatment activity applying herbicides that would ensure the proper use and application of these chemicals. No increased risk of accidental upset or emission of hazardous materials would occur. The impact is **less than significant**.

<u>Herbicides</u>

The toxicity of a pesticide (i.e., herbicides and fungicides) is determined by the documented adverse laboratory and field effects to target and non-target organisms that occur after an exposure to that compound. The key to potential adverse (toxic) effects is the nature of the exposure to the compound, which is based on the specific amount of the compound that reaches an organism's tissues (i.e., the dose). Several other factors are involved in an exposure, such as the duration of time over which the dose is received, the target tissue or physiological function affected, and the sensitivity of the organism of interest to the compound.

The toxicity of pesticides are generally measured in controlled laboratory or field studies in which the test organisms are provided only contaminated food (or oral doses of a test substance) at several concentrations for certain times from which a series of toxicity estimates are developed. Most studies are designed to evaluate toxic responses based on tiered increases of dose and to determine at what dose the onset of an adverse physiological or behavioral effect occurs. Toxicity studies commonly evaluate the lethal dose (LD) or the lethal concentration for half of a population (LC50), the highest dose that results in no toxicity to the test organisms (the NOAEL: no observed adverse effect level); or the lowest concentration that causes a measured adverse effect, such as mortality or altered reproduction, in the test organisms (the lowest observed adverse effect level [LOAEL]). In many acute (48 to 96 hours post-exposure) oral toxicity tests, laboratory organisms are not provided alternative food sources, and as a result, these laboratory tests are not particularly representative of realistic exposures in the environment. Furthermore, effects in laboratory species may not adequately represent effects in environmentally relevant species due to genetic, physiological, and behavioral differences. For many pesticides, the suite of tests required for approval of a compound includes other types of exposure, such as dermal, inhalation, and dietary. All of these laboratory data are combined to develop the pesticide product label recommendations and restrictions, incorporating several "safety" factors to provide acceptable use of each product. As a result of the extensive use of safety factors, surrogate test species, and unrealistic exposures to the laboratory animals, the pesticide data available for evaluation of potential adverse impacts for these compounds are subject to uncertainty and conservatism in actual potential effects as described in the Pesticide Technical Background Report (refer to Appendix D of this EIR).

Table 4.4-1 Chemicals Proposed for Use Under the VTP

Active Ingredients	CDPR Codes	Products Actively Registered in California [1]	
		Forestry	Rangeland
Borax, sodium tetraborate decahydrate	79	1	0
Clopyralid, monoethanolamine salt	5050	2	4
Glyphosate, diammonium salt [2]	5810	1	2
Glyphosate, dimethylamine salt	5972	1	1
Glyphosate, isopropylamine salt	1855	56	81
Glyphosate, potassium salt	5820	2	5
Hexazinone	1871	5	3
Imazapyr, isopropylamine salt	2257	7	1
Sulfometuron methyl	2149	3	1
Triclopyr, butoxyethyl ester (BEE)	2170	9	11
Triclopyr, triethylamine salt (TEA)	2131	10	5
Nonylphenol 9 Ethoxylates (NP9E)	1748	NA	NA

[1] The products listed are actively registered in California and include active ingredients proposed for use under the Program and Alternatives, as well as some products that contain additional active ingredients. CDPR = California Department of Pesticide Regulation.
[2] According to CDPR Pesticide Use Reports from 2000 to 2009, this chemical was not used in forestry (CDPR N.D.a). It was only used in rangeland in 2002 and 2010, on 2,800 acres and 5.5 acres respectively.

Table 4.4-1 provides a list of chemicals proposed for use under the VTP. Refer to Appendix D for a detailed description of these chemicals, including their mode of action, purpose under the VTP, and associated toxicity. The appendix was prepared by CAL FIRE in 2010. Because substantial time has elapsed since the preparation of the appendix, CAL FIRE contracted with Bill Williams, Ph.D, of Infinity Solutions Group (ISG) to prepare a technical peer-review of the information contained in the appendix and to update any outdated information or identify where new information has become available. As a result of that peer review process, it was determined that the information and analysis contained within the appendix was generally accurate. However, some new information and studies have become available since the time it was prepared. This new information is presented in the peer-review memo attached to and included in Appendix D. Nonetheless, the conclusions of the appendix were determined to be accurate for purposes of evaluating toxicity and ecological risk in this Program EIR (ISG 2015).

Chemicals proposed for use under the VTP are categorized by the most recent EPA risk assessments as having a ‘low’ or ‘very low’ chronic toxicity to non-target species. Further, none of the chemicals proposed to be used are listed on the California U.S. EPA’s Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65) as chemicals known to cause reproductive toxicity or cancer (Appendix D).

<u>Ecological Effects of Herbicide Use</u>

Chemical applications would occur in a variety of habitats and settings throughout the State. The herbicides selected for the VTP have been screened for minimal ecological toxicity and environmental fate, minimal transport, and proven efficacy against targeted species (Appendix D). As described in SPR HAZ-3, CAL FIRE when proposing or reviewing proposed VTP projects would first evaluate if there are other viable non-herbicide treatment options to address vegetation treatment. Only if it is determined that other treatment options are not available or feasible at a particular site, would CAL FIRE proceed with herbicide treatments.

While vegetation treatment activities may be located near sensitive habitats occupied by special-status species, VTP projects would be subject to the requirements of SPRs HAZ-4, HAZ-5, HAZ-7 through HAZ-13, which would require the proper handling and application of herbicides in accordance with label recommendations. SPR BIO-13 requires that contractors be provided training in the identification and avoidance of sensitive species and their habitats. Further, SPR BIO-3 requires that a survey of the project area be conducted to determine the presence of any sensitive habitats or species or special-status plant species. If aquatic habitats, sensitive habitats, or sensitive species are identified, these areas shall be marked and no application of herbicides shall occur within 50 feet of these areas (BIO-7). If it is determined that areas where aquatic habitat, sensitive habitats, or sensitive species cannot be avoided, the proposed VTP project would not qualify for implementation under the VTP Program EIR and CAL FIRE would need to proceed with separate environmental review for that project. Finally, no herbicides would be applied within 15-feet of any identified special-status plant species (BIO-7). Herbicide application, when conducted consistent with the VTP and the required SPRs would not affect special-status species, aquatic habitats, or sensitive habitats and natural communities and this would be a **less-than-significant** impact.

Herbicide treatment could coat the food sources of special-status mammals, resulting in indirect herbicide ingestion. However, impacts to these species resulting from food source exposure would be less than significant because of the limited potential for exposure and low toxicity to small mammals of the dilute herbicides used for this project. As outlined in Appendix D of this document, all proposed herbicides and adjuvants/surfactants have a low toxicity or are practically non-toxic to humans. While special-status mammals were not specifically addressed in toxicity studies, testing for human toxicity was primarily conducted on rabbits and rats, and it can be expected that effects on special-status mammals is similar to those found in humans. Herbicide treatment represents a small percentage (approximately 10 percent of VTP activities annually) of vegetation treatment activities covered under the VTP and would only be selected if other non-herbicide treatment activities are not feasible (SPR HAZ-3). Further, treatments would likely occur at most once per year for a particular site at doses that that are low to non-toxic to humans and are not anticipated to affect special-status mammals. Given the limited nature of the treatment application, it is unlikely that prey insects would be exposed to herbicide spray, and less likely that special-status species would consume such insects as they would represent only a tiny portion of the overall food supply. Overall, this would be a **less-than-significant** impact.

IMPACT 2: EXPOSURE OF PEOPLE TO EXISTING HAZARDOUS MATERIALS OR SOIL CONTAMINATION

Treatment activities under the VTP may occur on properties where hazardous materials have been previously used, stored, or released, including former agricultural areas or areas near contaminated urban areas. SPR HAZ-1 requires the project coordinator to conduct an Envirofacts web search to identify any known contamination sites within the project area prior to implementation of vegetation treatment projects. If a proposed vegetation treatment project would occur in an area 1) located on the DTSC Cortese List; 2) previously used for industrial/manufacturing purposes, or 3) that involved the use, handling, transport, or storage of hazardous materials, no treatment activities would occur within 100 feet of the site boundaries (HAZ-1). With identification and avoidance of contaminated sites during vegetation treatment activities, impacts related to human exposure to hazardous materials in soils would be **less than significant**.

IMPACT 3: HAZARDS RELATED TO SMOKE FROM PRESCRIBED BURNS.

Prescribed burning is the intentional use of fire to reduce wildfire hazards, clear downed trees, control plant diseases, improve rangeland and wildlife habitats, and restore natural ecosystems. Prescribed burning produces smoke, which may create hazards for people in the project area if not carefully managed.

California's smoke management program is an integrated State and local effort. The State Smoke Management Guidelines, adopted by the California Air Resources Board (ARB), establish the fundamental framework for the program. Additionally, individual local air districts implement and enforce local rules and regulations. CAL FIRE is required to prepare a smoke management plan before obtaining ARB permission to burn (SPR AIR-12). As with all burners, CAL FIRE is required to complete the following planning steps: 1) register their burn with the air district; 2) obtain an air district and/or fire agency burn permit; 3) submit a smoke management plan (SMP) to the air district; and 4) obtain air district approval of the SMP. The SMP specifies the "smoke prescription," which is a set of air quality, meteorological, and fuel conditions needed before burn ignition may be allowed.

In addition to required compliance with State Smoke Management Guidelines, CAL FIRE would also implement SPRs AIR-9, FBE-1 and FBE-4 to further reduce the potential for exposure of people to hazards from smoke as a result of prescribed burns under the VTP. This would be a **less-than-significant** impact.

IMPACT 4: WILDLAND FIRE HAZARDS.

As described above, under Section 4.4.1.3.1, Wildland Fire Hazards, CAL FIRE designates SRA lands as zones of moderate, high, and very high fire hazard severity, based on local vegetation types, slope, and weather. Locations associated with fire hazard severity zones are shown in Figure 4.1-1 of this Program EIR.

Manual and mechanical VTP activities would include creation of defensible space and fuel breaks through the use of mechanical gas-powered equipment (e.g., chainsaws, chippers, Jawz, mowers, etc.). While use of mechanical equipment could ignite dry vegetation and cause fire, CAL FIRE staff is trained in fire suppression techniques and would provide appropriate fire suppression equipment (e.g., extinguishers, water trucks, fire trucks) onsite in the event of an inadvertent ignition. Implementation of HAZ-14 requires all heavy equipment to include spark arrestors or turbo chargers with fire extinguishers onsite and FBE-1 requires prescribed burns to take place when burn intensities are low to moderate, such as during the spring season when the ground is wet or the fall season when plant moisture content is higher. Further, implementation of the VTP would result in the reduction of fuel loads on SRA lands, thereby, reducing overall fire ignition risk compared to existing conditions. This is an objective of the project and benefit of the program.

Chemical treatment options associated with VTP activities would result in transportation, use, and storage of pesticides. Although pesticides may pose some risk of increased fire because of their flammable properties, CAL FIRE would implement SPRs HAZ-4, HAZ-5, and HAZ-7 through HAZ-13, to reduce hazards associated with handling of flammable materials, and overall fuel loads on proposed treatment areas would be reduced.

With regards to the effects of climate change on California's fuel mix, please refer to Section 4.14 of this EIR for a detailed discussion.

The proposed VTP is designed to reduce fire risk within proposed WUI treatment areas, ecological restoration treatment areas, and strategic fuel break treatment areas throughout California (see Figures 2.3-2 through 2.3-4 for an illustration of proposed treatment areas by bioregion). VTP activities would reduce the risk of loss, injury, or death associated with a wildland fire through actions promoting prevention and effective response as well as implementation of SPRs described above. Overall, the VTP would have **no adverse impacts** to the environment related to wildland fire hazards.

4.4.2.4 **Hazardous Materials Impact Analysis for Alternatives Considered**

Four alternatives are considered under this analysis: Alternative A: WUI Only, Alternative B: WUI and Fuel Breaks, Alternative C: Projects Limited to Very High Fire Hazard Severity Zones, and Alternative D: Treatments that Minimize Potential Impacts to Air Quality. Alternative A proposes to limit fuel reduction projects to WUI areas only, while Alternative B would combine Alternative A with the option to create fuel breaks outside of the WUI. Under Alternative C, vegetation treatment activities would be focused in areas with the highest hazard classification of very high fire hazard severity zones (VHFHSZ). Alternative D would reduce the number of acres treated by prescribed fire and also reduce the average number of acres treated annually to 36,000.

For Alternatives A, B, and C, the scale of the project remains the same as the proposed VTP at 60,000 treated acres per year for ten years, with the same vegetation treatment activities by vegetation type expected to occur. That is, the same amount of acreage would be treated with manual, mechanical, prescribed fire, and herbicide treatments. Geographically, the areas available to be treated by Alternatives A, B, and C are reduced compared to the proposed VTP: Alternatives A and C would have approximately 11.5 million acres available for treatment, while Alternative B would have approximately 16 million acres available for treatment (see Table 3.8-1). The reduced acres available for treatment may increase the likelihood of treatments concentrating in a localized area, but the likelihood is minimal as less than 0.5% of the area available to be treated will be treated in any given year, and only a fraction of those will involve the use of herbicides or other hazardous materials. Implementation of SPR HYD-16 would further reduce the likelihood of treatments concentrating at the planning watershed level. Because the nature of treatment activities are expected to be the same and the scale of the program is similar to that of the VTP, it is reasonable to assume that hazardous materials impacts associated with the VTP would be similar under each of these alternatives. As a result, impacts from exposure, handling, and transport of hazardous materials, smoke-related hazards, and ecological toxicity hazards expected from Alternatives A, B and C would have a similar impact to the project and would be required to implement the same SPR's and mitigation measures. Overall, impacts would be similar to the project for Alternatives A, B, and C.

Alternative D proposes to treat less acres (36,000 annually) than the proposed VTP, and use less prescribed fire (approximately 6,000 acres annually) on an annual basis. Geographically, the area available for treatment would be the same as the proposed VTP as the treatments would be distributed across the landscape under the same constraints. Projects under alternative D would be required to implement the same SPR's and mitigation measures as the proposed VTP. It is reasonable to assume that a reduction of 80 percent, or 24,000 acres, under this Alternative would further reduce hazards related to smoke from prescribed fires. As a result, overall impacts related to smoke hazards would be expected to be reduced. However, this impact was determined to be less than significant with implementation of SPRs. Hazardous impacts associated with the VTP from other treatment activities would be expected to be the same as the proposed VTP because the same number of acres are expected to be treated using mechanical, manual, prescribed herbivory, and herbicides treatment activities. Furthermore, because the same type of treatment activities are expected to occur in the same areas, impacts from exposure, handling, transport of hazardous materials, and ecological toxicity hazards would have similar impacts as the proposed VTP project and would be required to implement the same SPR's. Overall, Alternative D would result in slightly less hazardous impacts compared to the Proposed Program because of the reduced smoke hazards that would occur throughout the State.

4.4.3 MITIGATION AND STANDARD PROJECT REQUIREMENTS

Under this analysis there are no mitigations. However, several Standard Project Requirements have been developed as part of the project design.

HAZ-1: Prior to the start of vegetation treatment activities, the project coordinator shall conduct an Envirofacts web search to identify any known contamination sites within the project area. If a proposed vegetation treatment project occurs in areas located on the DTSC Cortese List, no activities shall occur within 100 feet of the site boundaries.

HAZ-2: Prior to the start of vegetation treatment activities, the project coordinator or contractor shall inspect all equipment for leaks and regularly inspect thereafter until equipment is removed from the site.

HAZ-3: Prior to the selection of treatment activities, CAL FIRE shall determine if there are viable, cost-effective, non-herbicide treatment activities that could be implemented prior to the selection of herbicide treatments.

HAZ-4: Prior to the start of herbicide treatment activities, the project coordinator shall prepare a Spill Prevention and Response Plan (SPRP) to provide protection to onsite workers, the public, and the environment from accidental leaks or spills of herbicides, adjuvants, or other potential contaminants. This plan shall include (but not be limited to):

- A map that delineates VTP staging areas, where storage, loading, and mixing of herbicides will occur;
- A list of items required in a spill kit onsite that will be maintained throughout the life of the project;
- Procedures for the proper storage, use, and disposal of any herbicides, adjuvants, or other chemicals used in vegetation treatment.

HAZ-5: If remediation of hazardous contamination is needed, the project coordinator shall hire a licensed contractor with expertise in performing such work. The contractor shall comply with all laws and regulations governing worker safety and the removal and disposal of any contaminated material.

HAZ-6: All pesticide use shall be implemented consistent with Pest Control recommendations prepared annually by a licensed Pest Control Advisor.

HAZ-7: All appropriate laws and regulations pertaining to the use of pesticides and safety standards for employees and the public, as governed by the U.S. Environmental Protection Agency, the California Department of Pesticide Regulation, and local jurisdictions shall be followed. All applications shall adhere to label directions for application rates and methods, storage, transportation, mixing, and container disposal. All contracted applicators shall be appropriately licensed by the state. The project coordinator shall coordinate with the County Agricultural Commissioners, and all required licenses and permits shall be obtained prior to pesticide application.

HAZ-8: Projects shall avoid herbicide treatment in areas adjacent to water bodies and riparian areas. Application of herbicides shall be outside the WLPZ and ELZ as specified in HYD-3, or at the distances set forth in the herbicide label requirements, whichever is greater. No aerial spraying of herbicides shall occur under this Program EIR.

HAZ-9: The following general application parameters shall be employed during herbicide application:

- Application shall cease when weather parameters exceed label specifications, when sustained winds at the site of application exceeds seven miles per hour (MPH), or when precipitation (rain) occurs or is forecasted with greater than a 40 percent probability in the next 24-hour period to prevent sediment and herbicides from entering the water via surface runoff;
- Spray nozzles shall be configured to produce a relatively large droplet size;
- Low nozzle pressures (30-70 pounds per square inch [PSI]) shall be observed; and
- Spray nozzles shall be kept within 24 inches of vegetation during spraying.

Drift avoidance measures shall be used to prevent drift in locations where target weeds and pests are in proximity to special-status species or their habitat. Such measures can consist of, but would not be limited to the use of plastic shields around target weeds and pests and adjusting the spray nozzles of application equipment to limit the spray area.

HAZ-10: All herbicide and adjuvant containers shall be triple rinsed with clean water at an approved site, and the rinsate shall be disposed of by placing it in the batch tank for application per 3 CCR § 6684. Used containers shall be punctured on the top and bottom to render them unusable, unless said containers are part of a manufacturer’s container recycling program, in which case the manufacturer’s instructions shall be followed. Disposal of non-recyclable containers will be at legal dumpsites. Equipment would not be cleaned and personnel would not bathe in a manner that allows contaminated water to directly enter any body of water within the treatment areas or adjacent watersheds. Disposal of all pesticides shall follow label requirements and local waste disposal regulations.

HAZ-11: Storage, loading and mixing of herbicides shall be set back at least 150 feet from any aquatic feature or special-status species or their habitat or sensitive natural communities.

HAZ-12: Appropriate non-toxic colorants or dyes shall be added to the herbicide mixture where needed to determine treated areas and prevent over-spraying.

HAZ-13: For treatment activities located within or adjacent to public recreation areas, signs shall be posted at each end of herbicide treatment areas and any intersecting trails notifying the public of the use of herbicides. The signs shall consist of the following information: signal word, product name, and manufacturer; active ingredient; EPA registration number; target pest; treatment location; date and time of application; date which notification sign may be removed; and contact person with telephone number. Signs shall be posted at the start of treatment and notification will remain in place for 72 hours after treatment ceases.

HAZ-14: All heavy equipment shall be required to include spark arrestors or turbo chargers that eliminate sparks in exhaust, and have fire extinguishers onsite.

4.5 WATER QUALITY

Vegetation treatment activities proposed by this Program have the potential to generate water quality impacts. The material presented in 4.5 has been broken into three sections:

- **4.5.1 – Affected Environment**
  - The Affected Environment section discusses the regulatory framework that limits impacts to water quality as well as the baseline water quality conditions in each Water Quality Region.
- **4.5.2 – Effects**
  - The Effect section outlines the potential impacts of implementing the proposed Program and the alternatives.
- **4.5.3 – Mitigations**
  - The Mitigation section provides the standard program requirements and project specific requirements that prevent the proposed Program from causing significant adverse impacts to water quality.

4.5.1 AFFECTED ENVIRONMENT

4.5.1.1 Regulatory Setting

The areas affected by the Program are subject to the following water quality-related requirements associated with federal and state regulations.

CLEAN WATER ACT (33 U.S.C. SECTION 1251 ET SEQ.)

The Clean Water Act (CWA) is a 1977 amendment to the Federal Water Pollution Control Act of 1972. The CWA provides standard regulations for the discharge of pollutants to the waters of the United States (U.S.) in order to maintain their chemical, physical, and biological integrity and protect their beneficial uses. In addition, the CWA provides the statutory basis for the National Pollutant Discharge Elimination System (NPDES). Waters of the U.S. are defined as coastal waters, territorial seas, bays, rivers, streams, lakes, ponds, and wetlands (Code of Federal Regulations 40 CFR 122.2).

The CWA requires states to adopt water quality standards that must be approved by the U.S. Environmental Protection Agency (EPA) and requires NPDES permits for the discharge of pollutants in U.S. waters. In addition, the CWA gives authority to the EPA to (1) implement pollution control programs, including setting waste water standards and effluent limits on an industry-wide basis; and (2) authorize the NPDES Permit Program permitting, administration, and enforcement to state governments with oversight by the EPA.

Under Section 303(d) of the CWA, states (states, territories, and tribes) are required to develop lists of impaired and threatened waters. Impaired waters (e.g., rivers, streams, and lakes) are defined as those that do not meet water quality objectives because required pollution control mitigations are not sufficient to attain or maintain these standards. A 303(d) listing acts a “trigger” for states to monitor these waterbodies and develop Total Maximum Daily Loads (TMDLs) for each pollutant. The TMDL is a calculation of the maximum allowable amount of a pollutant impaired waters can receive without significant negative environmental effects, violation of water quality standards, and/or harm to beneficial uses. The TMDL process also provides an analysis of the linkages between pollutant reductions and the attainment of water quality objectives. The TMDL may also function as an action plan that provides management priorities and mitigation strategies for addressing water quality impairments. The EPA must approve a state’s TMDL or, if denied, the EPA will prepare and implement its own.

Sections under “Title IV-Permits and Licenses” of the Clean Wwater Act regulate the permits and licenses required for any activity that could impair surface waters.

- Section 401, enforced by the SWRCB and RWQCBs, requires the discharger to obtain certification from the state that potential discharges will comply with approved effluent limits and water quality standards.
- Section 402 regulates the point- and non-point source discharges to surface waters through the NPDES permit program. The NPDES permit program is overseen by the SWRCB and administered by each RWQCB. A general (covers multiple facilities within a specific category) or individual NPDES permit is required for any municipal or industrial point-source discharge and nonpoint-source stormwater discharge. NPDES permits set limits on allowable pollutant emissions or effluent discharges, prohibit the discharges not specifically allowed by the NPDES permit, and provide the discharger with required mitigations to monitor and reduce potential point- and nonpoint-source pollutant discharges. NPDES permits issued for listed pollutants must be consistent with TMDL load allocations.
- Section 404, regulated by the U.S. Army Corps of Engineers (USACE), requires a permit prior to any activity that involves the discharge of dredged or fill material into waters of the U.S. at designated approved locations. Projects with impacts less than or equal to 0.5 acres may be approved through the Nationwide Permit Program (NWP).

Phase I and Phase II of the EPA stormwater program were promulgated under the CWA in order to further protect water quality, aquatic habitat, and beneficial uses from stormwater runoff. The EPA stormwater program requires that projects involving more than one acre of ground disturbance develop and obtain approval of a Stormwater Pollution Prevention Plan (SWPPP) prior to construction activities, and the implementation of best management practices (BMPs) to control runoff from construction sites during and after construction operations. A Notice of Intent (NOI) must be submitted to the SWRCB when a project is subject to a NPDES permit. Construction projects involving less than one acre of ground disturbance are exempt from these regulations.

SECTIONS 9 AND 10 OF THE RIVERS AND HARBORS ACT (33 U.S.C. 401 ET SEQ.)

Sections 9 and 10 of the Rivers and Harbors Act (33 U.S.C. 301 et seq.) are regulated by the USACE and require a permit for the construction of any structure within or over "navigable waters," including excavation, dredging, or deposition of material in or any obstruction or alteration of navigable waters. Navigable waters include coastal and inland waters, lakes, rivers, and streams that are wide and deep enough to provide passage; territorial seas; and wetlands adjacent to aforementioned navigable waters. A Section 10 Permit is also required in un-navigable waters, if the activity will have an influence on course, location, condition, or capacity of a navigable water body.

FEDERAL ANTIDEGRADATION POLICY (CODE OF FEDERAL REGULATIONS - TITLE 40: PROTECTION OF ENVIRONMENT 40 CFR 131.12)

The Federal Antidegradation Policy was issued in 1968 by the U.S. Department of the Interior to (1) ensure that activities will not lower the water quality of existing use, and (2) restore and maintain "high quality water." The federal policy maintains that states shall adopt a statewide antidegradation policy that includes the following conditions:

- Existing instream water uses and a level of water quality necessary to maintain those uses shall be maintained and protected.
- Water quality will be maintained and protected in waters that exceed water quality levels necessary for supporting fish, wildlife, recreational activities, and water quality, unless the State deems that water quality levels can be lowered to accommodate important economic or social development. In these cases, water quality levels can only be lowered to levels that support all existing uses.
- Where high quality waters constitute an outstanding national resource, such as waters of National and State parks and wildlife refuges and waters of exceptional recreational or ecological significance, that water quality shall be maintained and protected.

PORTER-COLOGNE WATER QUALITY ACT (CAL. WATER CODE DIV. 7)

The Porter-Cologne Water Quality Act is a key element of California water quality control legislation. Under the Act, the SWRCB is given authority over state water rights and water quality policy, and the State's nine RWQCBs were established to regulate and oversee regional and local water quality issues. The RWQCBs are also responsible for developing and updating Basin Plans targeted toward (1) protecting waters designated with beneficial uses, (2) establishing water quality objectives for surface water and groundwater, and (3) determining actions necessary to maintain water quality standards and control point- and nonpoint-sources of pollution into the State's waters. Under the Act, proposed waste dischargers are required to file Reports of Waste Discharge (RWDs) to the RWQCB; and the SWRCB and RWQCBs are granted jurisdiction over the issuance and enforcement of Waste Discharge Requirements (WDRs), NPDES permits, and Section 401 water quality certifications.

CALIFORNIA STATE ANTIDEGRADATION POLICY (SWRCB RESOLUTION NO. 68-16, "POLICY WITH RESPECT TO MAINTAINING HIGHER QUALITY WATERS IN CALIFORNIA")

In 1968, the State of California adopted an antidegradation policy in response to directives under the Federal Antidegradation Policy. The antidegradation policy applies to high quality waters of the State, including surface waters and groundwater, and all existing and potential uses. The policy requires that high quality waters be maintained to the maximum extent possible and any proposed activities that can adversely affect high quality surface water and groundwater must (1) be consistent with the maximum benefit to the people of the State, (2) not unreasonably affect present and anticipated beneficial use of the water, and (3) not result in water quality less than that prescribed in water quality plans and policies.

4.5.1.2 REGIONAL WATER QUALITY CONTROL BOARDS

The affected area is comprised of nine Regional Water Quality Control Boards. The Regional Board boundaries are based on watersheds and water quality requirements are based on unique differences in climate, topography, geology and hydrology for each watershed. Regional board boundaries and overlapping CAL FIRE Unit and contract county boundaries are illustrated in Figure 4.5-1. Table 4.5-1 summarizes climatic, hydrologic, and water quality-related information for each Water Quality Region. Tables 4.5-2 and 4.5-3 summarize the beneficial uses and water quality objectives for each Water Quality Region, respectively.

North Coast	San Francisco Bay	Central Coast	Los Angeles	Central Valley		Lahontan	Colorado River	San Diego	Santa Ana
HUU	LNU	BEU	SBC	SKU	BEU	LMU	BDU	RRU	BDU
SKU	MRN	SLU	VNC	LMU	TUU	NEU	RRU	ORC	RRU
LMU	CZU	SBC	LAC	SHU	SLU	BDU	MVU	MVU	ORC
SHU	SCU	VNC		TGU	VNC	LAC			
TGU		CZU		MEU	LAC	AEU			
MEU		SCU		NEU	AEU	KRN			
LNU		KRN		LNU	TCU				
MRN				BDU	SCU				
				FKU	KRN				
				MMU	BTU				

Figure 4.5-1 Regional Water Quality Control Board jurisdictional boundaries overlaid with CAL FIRE Unit and Contract County boundaries

NORTH COAST REGION – REGION 1

The North Coast Region receives more precipitation than any other part of California. Abundant in surface and groundwater resources, the North Coast Region constitutes only about 12 percent of the area of California but produces about 40 percent of the annual runoff. Encompassing some 19,390 square miles, including 340 miles of coastline and remote wilderness, urban and agricultural areas, the North Coast Region is divided into two natural drainage basins – the Klamath River Basin and the North Coast Basin.

Two distinct temperature zones characterize the Region. Along the coast, the climate is moderate and foggy, with little temperature variation. Inland seasonal temperatures can exceed 100°F. The numerous streams and rivers of the region contain anadromous fish, including coho and Chinook salmon and steelhead trout. The Region's few reservoirs support both cold and warm water fish.

Klamath River Basin

The Klamath River Basin covers approximately 10,830 square miles within northern California, and includes the Klamath, Trinity, Smith, Shasta, Scott, and Salmon River. The western portion of the Basin is within the Klamath Mountains and Coast Ranges geomorphic provinces, characterized by steep, rugged peaks ranging to elevations of 6,000 to 8,000 feet with relatively little valley area. The mountain soils are shallow and often unstable. Precipitation ranges from 60 to 125 inches per year. The eastern portion of the Basin includes predominantly high, broad valleys ranging from 4,000 to 6,000 feet in elevation. It receives low to moderate rainfall, typically 15 to 25 inches annually.

North Coastal Basin

The North Coastal Basin covers approximately 8,560 square miles along the north-central coast. Most of the Basin consists of rugged, forested coastal mountains dissected by the Eel, Russian, Mad, and Mendocino coastal rivers (Gualala, Garcia, Navarro, Big, and Noyo), as well as numerous smaller river systems. Soils are generally unstable and erodible, and rainfall is high. Major population areas center around Humboldt Bay to the north and Santa Rosa to the south.

SAN FRANCISCO BAY REGION – REGION 2

The San Francisco Bay Region, centrally located along our state's coastline, marks a natural topographic separation between the northern and central parts of the California Coast Ranges geomorphic province. More than seven million people live in the 4,600-square-mile area. The San Francisco Bay estuarine system drains 40 percent of California and includes the Central Valley Region's Sacramento and San Joaquin Rivers, which account for 90 percent of freshwater flow into the bay. The San Francisco estuary is the largest estuary on the west coast of North and South America and forms the centerpiece of the nation's fifth largest metropolitan area, comprising San Francisco, Oakland, and San Jose.

The Region includes all or major portions of nine counties. With a Mediterranean climate of mild, wet winters and cool, dry summers, the Region encompasses a range of microclimates from the foggy coast to the dry inland. The mean annual precipitation varies from 14 to 49 inches. Flows are highly seasonal, with more than 90 percent of the annual runoff occurring between November and April. Many streams are dry during the summer months.

The land surrounding the San Francisco Bay is densely populated and highly urbanized, with channelized creeks and flood control structures, dams and reservoirs. A heavily industrialized corridor runs along the Contra Costa shoreline from Richmond to Pittsburg, home to major oil refineries and chemical companies. The land draining into the northern reaches of the estuary, which includes the San Pablo and Suisun bays, supports pockets of urbanization within open space and extensive crop and range land, including vineyards in Napa and Sonoma counties and dairies in Sonoma and Marin counties. The less developed coastal watersheds in Marin and San Mateo counties support listed populations of salmon and steelhead. Contaminants from urban runoff, mining and pesticide application are major concerns in this Region.

CENTRAL COAST REGION – REGION 3

The Central Coast Region includes all of Santa Cruz, San Benito, Monterey, San Luis Obispo and Santa Barbara counties and small portions of several other counties. The region contains 2,360 miles of streams, 99 lakes comprising 25,000 acres, and over 8,000 acres of wetlands and estuaries. Prime agricultural lands dominate the bottomlands of many watersheds, and upper watersheds are in rugged National Forest lands. The area ranges climatically from the extremely wet Santa Cruz Mountains to the very arid Carrizo Plain. Important marine resources have been afforded protection through two National Marine Sanctuary programs and the Morro Bay National Estuary Program.

LOS ANGELES REGION – REGION 4

With more than 10 million residents, the Los Angeles Region is the most densely populated region in the state. Agriculture and open space exist alongside urban, residential, commercial, and industrial areas. Open spaces in northern Los Angeles County are steadily giving way to residential communities. The Los Angeles Regional Board regulates over 1,000 point source discharges of wastewater.

The Region has designated 10 watershed management areas. The Los Angeles and San Gabriel River watersheds are heavily urbanized in their lower stretches but retain largely undeveloped open space areas in their upper portions. The Santa Monica Bay watershed contains a mixture of urbanized and more rural areas, all of which drain into Santa Monica Bay, a designated waterbody under the National Estuary Program. The Santa Clara River, Ventura River and Calleguas Creek watersheds contain many small urban centers, but also support large areas of agriculture. The Dominguez Channel Watershed is a heavily urbanized and industrialized area that drains into Los Angeles Harbor, and in combination with Long Beach Harbor, forms the largest industrial port on the West Coast.

The Los Angeles Region encompasses all of the coastal watersheds of Los Angeles and Ventura counties, along with small portions of Kern and Santa Barbara counties and the drainages of five coastal islands (Anacapa, San Nicolas, Santa Barbara, Santa Catalina, and San Clemente). The Region also includes all coastal waters within three miles of the continental and island coastlines.

Most precipitation in the Los Angeles Region occurs during just a few major storms each year, averaging from about 15 inches annually in Ventura County to almost 40 inches in certain mountainous areas. Average rainfall is slightly lower in Los Angeles County, but varies widely between valleys and mountains.

CENTRAL VALLEY REGION – REGION 5

The Central Valley Region is the State's largest, encompassing 60,000 square miles, or about 40 percent of the State's total area. Thirty-eight of California's 58 counties are either completely or partially within the Central Valley Regional Board's boundaries, formed by the crests of the Sierra Nevada on the east, the Coast Ranges and Klamath Mountains on the west, the Oregon border on the north, and the Tehachapi Mountains on the south. The Sacramento and San Joaquin Rivers, along with their tributaries, drain the major part of this large area through an inland Delta, before emptying into San Francisco Bay. The Delta is the focal point of the state's two largest water conveyance projects, the State Water Project and the federal Central Valley Project. Together, the Sacramento and San Joaquin Rivers and the Delta furnish over half of the state's water supply. The southern third of the Central Valley contains the Tulare Lake Basin, a closed hydrographic unit, except during extremely wet years.

The Central Valley Region provides over 50 percent of the state's managed water supply and contains approximately 77 percent of the state's irrigated agriculture. The Region contains 83,624 miles of rivers and streams; 504,350 acres of lakes, reservoirs, and ponds; and 400,000 acres of wetlands. Approximately 1,510 miles of waterways are dominated by agricultural discharge, and there are 19,812 miles of constructed agricultural drains.

LAHONTAN REGION – REGION 6

The Lahontan Region is the second largest region in California, spanning 33,000 square miles of eastern California from the Oregon border in the north to the Mojave Desert, San Bernardino Mountains, and eastern Los Angeles County in the south. The Region is nearly 600 miles long and includes the highest and lowest points in the contiguous United States (Mount Whitney at 14,494 feet and Badwater, Death Valley at -282 feet, respectively).

The Lahontan Region has more than 3,000 miles of streams, 1,581 square miles of groundwater basins, and more than 700 lakes, including two designated Outstanding National Resource Waters – Lake Tahoe and Mono Lake – and numerous other high-quality waterbodies that are eligible for the same status. Due to the enormity of the Region's north-south span and its variety of elevations, the Region contains diverse habitats, ranging from alpine mountain environments that receive heavy snowpack most years, to low-elevation, dry deserts. A great range of habitats, precipitation regimes and ecosystem types exist between the two elevation extremes. In addition, topography, past glaciation and climatic changes have led to the existence of "ecological islands" and the evolution of species, subspecies, and genetic strains of plants and animals in that are found nowhere else. Particularly notable are fish such as the Eagle Lake trout, Lahontan and Paiute cutthroat trout, Mojave tui chub, and several kinds of desert pupfish.

COLORADO RIVER REGION – REGION 7

The Colorado River Basin Region covers approximately 20,000 square miles in the southeastern corner of California, the most arid part of the state. The region includes all of Imperial County and portions of San Bernardino, Riverside and San Diego counties. Altogether, the region has 250,000 acres of lakes and 900 miles of streams and rivers. Annual average rainfall varies from three to four inches.

The region is divided into three watersheds: the Lower Colorado River, Salton Sea Transboundary, and Desert Aquifers. The Desert Aquifers watershed has little surface water and hundreds of aquifers. The majority of the Region's surface waters are in the Imperial Valley and East Colorado River Basin planning areas.

The Salton Sea Transboundary watershed, encompassing the Coachella and Imperial Valleys, is the priority watershed for the Colorado River Basin, containing five of the six 303(d) listed impaired surface waterbodies in the Region. Water from the Colorado River has created an irrigated agricultural ecosystem throughout this watershed. Wildlife and aquatic species are dependent on habitat created and maintained through the discharge of agricultural return flows. Major waterbodies in the watershed include the Salton Sea, Alamo River, New River, Imperial Valley Agricultural Drains, and Coachella Valley Storm Water Channel.

SANTA ANA REGION – REGION 8

Despite being the smallest of California's nine Regional Water Quality Control Boards (2,800 square miles), the Santa Ana Region is one of the most densely populated with five million residents. The Region includes most of Orange County and portions of Riverside and San Bernardino counties. The Mediterranean climate is generally dry in the summer, with wet mild winters. Average annual rainfall is approximately 15 inches, occurring largely between November and March. The Region contains 460 miles of streams; more than 17 lakes and reservoirs; 11 bays, estuaries and tidal prisms; and more than 10 wetlands.

The Region's two main rivers are the Santa Ana River and the San Jacinto River. The Santa Ana River originates in the San Bernardino Mountains and flows through San Bernardino, Riverside and Orange counties on its way to the ocean. It transports more than 125 million gallons per day of recycled water from Riverside and San Bernardino counties for recharge into the Orange County Groundwater Basin and satisfies approximately 40 percent of Orange County's water demand. The San Jacinto River, a major tributary to the Santa Ana, is ephemeral, flowing only during large storm events. The terminus of the San Jacinto River is typically Lake Elsinore during most storms. When large storm events occur, Lake Elsinore spills to join the Santa Ana River via Temescal Creek.

Except for coastal streams that empty directly into the ocean, the stream network in the Santa Ana Region is made up of first, second, third, and fourth order streams that empty directly into the Santa Ana River or the San Jacinto River. The Santa Ana Region is also home to significant coastal water resources, including several miles of beaches, Newport Bay, Upper Newport Bay Ecological Reserve, Anaheim Bay, Huntington Harbour, Bolsa Chica Ecological Reserve, and two State Water Quality Protection Areas.

The Region's population density and resulting land use activities affect its water resources. Many of the Region's surface waterbodies are included on the Clean Water Action Section 303(d) list, having impaired waterbodies due to excessive nutrients, excessive bacterial levels, and contamination due to legacy pesticide usage.

SAN DIEGO REGION – REGION 9

The San Diego Region stretches along 85 miles of coastline from Laguna Beach to the Mexican border and extends 50 miles inland to the crest of the Peninsular Ranges. It encompasses most of San Diego County, southwestern Riverside County, and southern Orange County. The Region's semi-arid (average annual precipitation of 10-13 inches) Mediterranean climate is generally mild. Relatively little precipitation falls in much of the Region, with most falling from November through March. It occurs principally as rain, with snow rare except in the higher mountains. The Region's population is more than three million.

The diverse water resources of the San Diego Region include the ocean, bays, estuaries, streams, freshwater wetlands, reservoirs, and groundwater. Altogether, there are 910 miles of streams, 19,220 acres of lakes, and 85 miles of coastline. All major drainage basins in the Region contain groundwater basins, which are generally relatively small in area and shallow. The Region has a variety of wetlands, including vernal pools, coastal salt marsh, freshwater marsh, and riparian woodlands. The Region's streams include perennial and non-perennial reaches, with some segments flowing for only a few days or months each year.

The Region imports approximately 90 percent of its water supply from northern California and the Colorado River, and much of this water is stored in local reservoirs. Nearly all of the local groundwater basins in the Region have been intensively developed for municipal and agricultural supply purposes. Recycled water is a growing component of the Region's water supply, and seawater desalination projects are planned or under construction.

Numerous waterbodies in the Region are known to be degraded due to several different stressors from various sources. Many of the region's surface waters are included on the Clean Water Act Section 303(d) list of waters where water quality objectives are not met. Most wetland areas have been filled, dredged, fragmented, or otherwise lost or degraded. The ecosystems of many stream systems and coastal lagoons have been modified by dams, water diversions, channelization, transportation corridors, runoff from urban and agricultural areas, invasive species, and other anthropogenic factors.

BENEFICIAL USES AND WATER QUALITY OBJECTIVES

State policy for water quality control in California is directed toward achieving the highest water quality consistent with maximum benefit to the people of the state. Aquatic ecosystems and underground aquifers provide many different benefits to California's citizens. The State and Regional Water Boards are charged with protecting these uses from pollution and nuisance that may occur as a result of waste discharges in the state. Beneficial uses of surface waters, groundwaters, marshes, and wetlands presented in Table 4.5-2 are the basis for establishing water quality objectives and discharge prohibitions to attain these goals.

Beneficial use designations for any given water body do not rule out the possibility that other beneficial uses exist or have the potential to exist. Existing beneficial uses that have not been formally designated in Regional Water Board Basin Plans are protected whether or not they are identified.

There are two types of water quality objectives: narrative and numerical. Narrative objectives present general descriptions of water quality that must be attained through pollutant control measures and watershed management. They also serve as the basis for the development of detailed numerical objectives.

Historically, numerical objectives were developed primarily to limit the adverse effect of pollutants in the water column. Numerical objectives typically describe pollutant concentrations, physical/chemical conditions of the water itself, and the toxicity of the water to aquatic organisms. These objectives are designed to represent the maximum amount of pollutants that can remain in the water column without causing any adverse effect on organisms using the aquatic system as habitat, on people consuming those organisms or water, and on other current or potential beneficial uses.

The technical basis of a Region's water quality objectives include extensive biological, chemical, and physical partitioning information reported in the scientific literature, national water quality criteria, studies conducted by other agencies, and information gained from local environmental and discharge monitoring. Limited information exists in some cases, making it difficult to establish definitive numerical objectives.

Together, the narrative and numerical objectives define the level of water quality that shall be maintained within the region. In instances where water quality is better than that prescribed by the objectives, the state Anti-degradation Policy applies (State Board Resolution 68-16: Statement of Policy With Respect to Maintaining High Quality of Waters in California). This policy is aimed at protecting relatively uncontaminated aquatic systems where they exist and preventing further degradation. The state’s Anti-degradation Policy is consistent with the federal Anti-degradation Policy, as interpreted by the State Water Resources Control Board in State Board Order No. 86-17.

When uncontrollable water quality factors result in the degradation of water quality beyond the levels or limits established herein as water quality objectives, the Regional Board will conduct a case-by-case analysis of the benefits and costs of preventing further degradation. In cases where this analysis indicates that beneficial uses will be adversely impacted by allowing further degradation, then the Regional Board will not allow controllable water quality factors to cause any further degradation of water quality. Controllable water quality factors are those actions, conditions, or circumstances resulting from human activities that may influence the quality of the waters of the state and that may be reasonably controlled. The Regional Board establishes and enforces Waste Discharge Requirements (WDRs) for point and nonpoint source of pollutants at levels necessary to meet numerical and narrative water quality objectives. In setting WDRs, the Regional Board will consider, among other things, the potential impact on beneficial uses within the area of influence of the discharge, the existing quality of receiving waters, and the appropriate water quality objectives.

In general, the objectives are intended to govern the concentration of pollutant constituents in the main water mass. The same objectives cannot be applied at or immediately adjacent to submerged effluent discharge structures. Zones of initial dilution within which higher concentrations can be tolerated will be allowed for such discharges. Water quality objectives for surface waters are summarized in Table 4.5-3.

Table 4.5-1 General environmental characteristics and water quality issues by California's Regional Water Boards.

Regional Water Quality Control Board	Precipitation	Runoff and Flood Hazard	Major Rivers & Waterbodies	Water Quality	Sedimentation	CAL FIRE Units within Regional Board Boundaries
North Coast - Region 1	Highest precipitation in the State with average annual precipitation of 50 inches. High intensity and long duration rainfall events are common during the winter period. Annual precipitation ranges from 15 inches in Modoc County to nearly 200 inches in northern Del Norte County. Heavy snowfall is limited to the higher elevations of the Klamath Mountains and Trinity Alps.	Highest peak discharge values in the State. Smaller coastal watersheds tend to exhibit rapid hydrograph response, with lower base flows and little snowmelt. In comparison, larger inland rivers experience slower hydrograph response, with higher base flows and significant snowmelt response.	Albion River Bear River Big River Bodega Harbor Eel River Garcia River Gualala River Humboldt Bay Klamath River Mad River Mattole River Navarro River Noyo River Redwood Creek Russian River Salmon Creek Scott River Shasta River Smith River Tenmile River Trinity River Van Duzen River.	Surface water issues: Erosion and sedimentation from timber harvesting, roads, and grazing; nonpoint source pollution from storm water runoff; channel modification, gravel mining and dairies; and MTBE, PCE, and dioxin contamination. Groundwater issues: Leaking underground tanks.	High rainfall, in combination with steep mountainous areas underlain in places by unstable geologies/soils, high uplift rates, and poor land use practices could result in higher peak discharges, erosion and sediment yields during storm events.	Humboldt Del-Norte, Lassen-Modoc, Mendocino, Shasta-Trinity, Siskiyou, Sonoma-Lake Napa.
San Francisco Bay - Region 2	Average precipitation for the Region is approximately 25 inches. Because of marine influences and rain shadows, the annual precipitation is 20-25 inches in the North Bay, 15-20 inches in the South Bay (east of the Santa Cruz Mountains), and more than 40 inches in the higher elevation west facing mountainous areas.	Small, steep watersheds are subject to high rainfall from short, intense storms. All rivers are prone to intense flooding during major storms events.	Alameda Creek, Corte Madera Creek, Coyote Creek, Green Valley Creek, Guadalupe River, Napa River, Novato Creek, Petaluma River, San Leandro Creek, San Lorenzo Creek, San Mateo Creek, San Pablo Creek, Sonoma Creek, Suisun Creek, Tomales Bay, Walnut Creek, Wildcat Creek.	Surface water issues: Erosion and sedimentation from timber harvesting, roads; agricultural runoff; nonpoint source pollution from storm water runoff; trace metals; toxic pollutants; habitat and wildlife degradation. Sources from irrigated agricultural runoff, sewage discharge, and industrial manufacturing. Groundwater issues: Drinking water impairment, salt water intrusion, and synthetic organics from irrigated agriculture and other nonpoint sources, overdraft, and industrial discharge.	Steep upland areas with unstable geologies are prone to erosion during large storm events and could deposit sediment in rivers and floodplains. Wildfires could result in sedimentation of rivers from increased surface erosion, rilling and gullying.	San Mateo-Santa Cruz, Santa Clara, Sonoma-Lake Napa.

Central Coast - Region 3	Primarily rainfall, insignificant snowfall. Average precipitation ranges between 12 and 42 inches per year. Interior southern valleys: 5-10 inches. Mountain areas: >50 inches.	All rivers in the region are prone to winter storm produced flooding. Small, steep watersheds are subject to short, intense floods. Limited seasonal base flow and no significant snowmelt runoff.	Big Sur River, Carmel River, Naciemento River, Salinas River, San Antonio River, San Benito River, Santa Maria River, Santa Ynez River.	Surface water issues: Erosion and sedimentation, wildlife and fisheries degradation, bacteria, eutrophication, metal from nonpoint surface runoff, and agricultural runoff. Groundwater issues: Drinking water impairment, nitrates, toxic pollutants, and saltwater intrusion caused by nonpoint surface runoff and groundwater overdraft.	Steep upland areas with unstable geologies are prone to erosion during large storm events and could deposit sediment in rivers and on floodplains. Wildfires could result in sedimentation of rivers from increased surface erosion, rilling, gullying, and subsequent debris flows.	San Benito-Monterey, San Luis Obispo, San Mateo-Santa Cruz, Santa Clara, Sonoma-Lake-Napa
Los Angeles - Region 4; Santa Ana - Region 8; San Diego - Region 9	Average annual precipitation is approximately 18 inches. Annual precipitation ranges from 10 inches in the valley areas to approximately 40 inches in the mountains.	Most rivers and creeks are intermittent or ephemeral with minor runoff from snowmelt. Short duration, intense winter storms in steep upland watersheds are the primary cause for flooding in these regions. Urbanization has resulted in drainages with high peak discharges and short lag times.	Carlsbad, Los Angeles River, Otay River, San Dieguito River, San Diego River, San Gabriel River, San Juan Creek, San Luis Rey River, Santa Ana River, Santa Clara River, Santa Margarita River, Santa Monica Bay, Sweetwater River, Tijuana River, Ventura River.	Surface water issues: Erosion and sedimentation from roads, ranching, and urban development; nonpoint source pollution from storm water runoff; erosion from inactive mines; agricultural runoff; mineral and gravel mining; nutrients; pathogens; heavy metals; hydromodification; and individual waste water systems. Groundwater issues: Drinking water impairment, salt water intrusion, toxic pollutants, and VOCs from industrial and agricultural runoff, overdraft, and underground storage and fuel tank leaks.	Typically low erosion and sediment yield due to urbanization. Steep channels and unstable geology, coupled with short duration, intense winter storms in steep upland watersheds can cause high rates of localized erosion and sediment yield from debris flows and mud flows.	Riverside, San Bernardino, San Diego.

Central Valley - Region 5	Annual average precipitation ranges from 13 inches in the Tulare Lake region to 37 inches in the Sacramento River watershed. Annual precipitation increases from south to north, and from west to east (i.e., valley floor to Sierra/Cascade crest). The high Sierra receives an average of approximately 35 inches in snowfall.	Major rivers receive high spring runoff from snowmelt from adjacent mountain streams and rivers. Snowmelt runoff and rain-on-snow events can cause erosion, sedimentation, and flooding. Flooding in the lowland areas is primarily related to large rain-on-snow events. Prolonged spring runoff can cause flooding in typically dry lakes in the southern portion of the region.	American River, Bear River, Butte Creek, Feather River McCloud River, Pitt River, Yuba River, Chowchilla River, Cosumnes River, Del Puerto Creek, Fresno River, Merced River, Mokelumne River, Orestimba Creek, Stanislaus River, Tuoloumne River, Kaweah River, Kern River, Kings River, San Joaquin River, Tulare Lake, Tule River.	Surface water issues: Erosion and sedimentation from timber harvesting, roads, grazing, rural development, dairies and agriculture; nonpoint source pollution from storm water runoff and individual waste water systems; impacts from historic mining (i.e., acid mine drainage and mercury. Groundwater issues: Drinking water impairment, salinity, toxic pollutants, VOCs from wastewater systems and septic tanks, irrigated agriculture and diary nonpoint sources, agricultural and industrial runoff, overdraft, and fuel tank leaks.	Erosion and sediment yields are generally low due to stable geologies and abundant vegetative cover. Although heavy storm rainfall and saturated soil conditions, coupled with land use practices (e.g., timber harvesting, grazing, agriculture, and poor road construction) could result in high erosion and sediment yields. Wildfires could result in sedimentation of rivers from increased surface erosion.	Amador-El Dorado, Butte, Fresno-Kings, Lassen-Modoc, Madera-Mariposa-Merced, Nevada-Yuba-Placer, Shasta-Trinity, Siskiyou, Sonoma-Lake-Napa, Tuolumne-Calaveras, Tulare, Tehama-Glenn.
Lahontan - Region 6	Average precipitation for the northern region is approximately 23 inches, primarily snowfall. Annual precipitation ranges from less than 5 inches in the valley areas of Lassen and Mono counties to more than 60 inches near the Sierra crest. Average precipitation in the south is approximately 8 inches, but varies considerably with rising elevation.	Lowland valley areas could experience high peak runoff in short and steep ephemeral drainages. Most watersheds are small and steep. Prolonged spring runoff and high base flow is typical of drainages on the east side of the Sierra Nevada. Many drainages are ephemeral and could experience rapid hydrograph response and resultant flooding.	Carson River, Surprise Valley, Susan River, Truckee River, Lake Tahoe, Walker River, Amargosa River, Antelope Valley, Mojave River, Mono Lake, Owens River.	Surface water issues: Erosion and sedimentation from logging, roads, and grazing; nonpoint source pollution from storm water runoff; acid drainage from inactive mines; individual waste water systems. Groundwater issues: Drinking water, salinity, and VOCs from mining drainage, overdraft, and fuel tank leaks.	Flashy storm flows with high peak discharge, lack of vegetation, poorly consolidated geology, and steep channel morphology could result in debris flows, erosion and sediment yield. Wildfires could result in sedimentation of rivers from increased surface erosion, rilling, and gullying.	Amador-Eldorado, Lassen-Modoc, Nevada-Yuba-Placer, San Bernardino.

Colorado River - Region 7	Lowest annual precipitation out of all the Regional Board areas. Average annual rainfall ranges from 3 to 6 inches.	Characterized by low annual rainfall and runoff, and sparse vegetation. Streams are typically low gradient and braided in valley areas and steep gradient in mountainous areas. Storms are generally of short duration and high intensity, and could result in flash floods in lowland alluvial fan areas. Ephemeral streams are prone to flooding during heavy rainfall events.	Alamo River, Colorado River, New River, Salton Sea, Whitewater River.	Surface water issues: Sedimentation, salinity, drinking water impairment, bacteria, pesticides, herbicides from agricultural runoff, wastewater, erosion, and diversions. Groundwater issues: Drinking water impairment and VOCs caused by groundwater overdraft and fuel tank leaks.	Erosion and sedimentation primarily from ravel, surface erosion, wind erosion, and as freeze-thaw. Short duration and high intensity storms could result in debris flows generated in steep mountainous areas. In comparison, lowland and valley areas tend to have lower erosion and sediment yields.	Riverside, San Bernardino, San Diego.

Table 4.5-2 Beneficial uses of water by Regional Water Quality Control Board. Acronyms are defined in the first column. Additional beneficial uses may occur for specific waterbodies within each Region.

North Coast	San Francisco	Central Coast	Los Angeles	Central Valley	Lahontan	Colorado River	Santa Ana	San Diego
Municipal and domestic supply (MUN)	AGR	MUN	MUN	MUN	AGR	MUN	MUN	MUN
Agricultural supply (AGR)	ASBS	AGR	AGR	AGR	AQUA	AGR	AGR	AGR
Industrial service supply (IND)	COLD	PROC	PROC	IND	BIOL	AQUA	IND	PROC
Industrial process supply (PROC)	COMM	IND	IND	PROC	COLD	IND	PROC	IND
Groundwater recharge (GWR)	EST	GWR	GWR	GWR	COMM	GWR	GWR	GWR
Freshwater replenishment (FRSH)	FRSH	FRSH	FRSH	FRSH	FLD	REC-1	NAV	FRSH
Navigation (NAV)	GWR	NAV	NAV	NAV	FRSH	REC-2	POW	NAV
Hydropower generation (POW)	IND	POW	POW	POW	GWR	WARM	REC-1	POW
Water contact recreation (REC-1)	MAR	REC-1	REC-1	REC-1	IND	COLD	REC-2	REC-1
Non-contact water recreation (REC-2)	MIGR	REC-2	LREC-1	REC-2	MIGR	WILD	COMM	REC-2
Commercial and sport fishing (COMM)	MUN	COMM	REC-2	COMM	MUN	POW	WARM	COMM
Aquaculture (AQUA)	NAV	AQUA	COMM	AQUA	RARE	FRSH	Limited warm freshwater habitat (LWRM)	AQUA
Warm freshwater habitat (WARM)	PROC	WARM	AQUA	WARM	REC-1	RARE		WARM
Cold freshwater habitat (COLD)	RARE	COLD	WARM	COLD	REC-2			COLD
Inland saline water habitat (SAL)	REC-1	SAL	COLD	EST	SAL		COLD	SAL
Estuarine habitat (EST)	REC-2	EST	EST	WILD	SPWN		BIOL	EST
Marine habitat (MAR)	SHELL	MAR	WET	BIOL	WARM		WILD	MAR
Wildlife habitat (WILD)	SPWN	WILD	MAR	RARE	NAV		RARE	WILD
Preservation of areas of special biological significance (ASBS)	WARM	BIOL	WILD	MIGR	POW		SPWN MAR	BIOL
Rare, threatened, or endangered species (RARE)	WILD	RARE	BIOL	SPWN	PROC		SHEL	RARE
Migration of aquatic organisms (MIGR)		MIGR	RARE	SHELL	WILD		EST	MIGR
Spawning, reproduction, and/or early development (SPWN)		SPWN	MIGR		WQE			SPWN
Shellfish harvesting (SHELL)		SHELL	SPWN					SHELL
Water quality enhancement (WQE)		ASBS	SHELL					
Flood peak attenuation/flood water storage (FLD)								
Wetland habitat (WET)								
Native American culture (CUL)								
Subsistence fishing (FISH)								

Table 4.5-3 Water quality objectives for surface waterbodies defined in the Water Quality Control Plans (Basin Plans) for the Regional Water Quality Control Boards.

North Coast	San Francisco Bay	Central Coast	Los Angeles	Central Valley	Lahontan	Colorado River	Santa Ana	San Diego
Color	Bacteria	Color	Ammonia	Ammonia	Ammonia	Bacteria	Algae	Iron
Bacteria	Bioaccumulation	Biostimulatory substances	Bacteria, Coliform	Bacteria	Bacteria, coliform	Aesthetic qualities	Ammonia, Un-ionized	Ammonia, un-ionized
Biostimulatory substances	Biostimulatory substances	Chemical constituents	Bioaccumulation	Biostimulatory substances	Biostimulatory substances	Biostimulatory substances	Bacteria, coliform	Biostimulatory substances
Chemical constituents	Chemical constituents	Dissolved oxygen	Biochemical oxygen demand	Chemical constituents	Chemical constituents	Chemical constituents	Boron	Boron
Dissolved oxygen	Color	Floating material	Biostimulatory substances	Color	Chlorine, total residual	Dissolved oxygen	Chemical oxygen demand	Chlorides
Oil and grease	Dissolved oxygen	Oil and grease	Floating material	Pesticides	Color	pH	Chloride	Color
Floating material	Floating material	Other organics	Chlorine, Total residual	Floating material	Dissolved oxygen	Pesticide wastes	Chlorine, residual	Dissolved oxygen
Pesticides	Oil and grease	Pesticides	Color	Mercury	Color	Radioactivity	Color	Floating material
pH	pH	pH	Dissolved oxygen	Methlymercury	Oil and grease	Sediment	Floatables	Fluoride
Radioactivity	Radioactivity	Radioactivity	Exotic vegetation	Oil and grease	Radioactivity	Toxicity	Hardness	Nitrate
Sediment	Suspended material	Sediment	Chemical constituents	Dissolved oxygen	Dissolved oxygen	Total dissolved solids	Dissolved soils, total	Suspended and settleable solids
Temperature	Salinity	Temperature	Habitat	pH	Pesticides	Temperature	Fluoride	Manganese
Toxicity	Sediment	Toxicity	Hydrology	Radioactivity	pH	Turbidity	Inorganic	Sediment
Tastes and odors	Settleable material	Tastes and odors	Methylene blue activated substances	Salinity	Floating materials	Suspended solids and settleable solids	Filterable residue, total	Inorganic chemicals
Suspended material	Sulfide	Suspended material	Mineral quality	Sediment	Sediment	Tainting substances	Metals	Oil and grease
Settleable material	Tastes and odors	Settleable material	Nitrogen	Settleable material	Settleable materials		Radioactivity	Organic chemicals
Turbidity	Temperature	Turbidity	Oil and grease	Turbidity	Taste and odor		Nitrate	Sulfate
	Toxicity		Pesticides	Tastes and odors	Temperature		Nitrogen, total inorganic	Pesticides
	Turbidity		pH	Temperature	Toxicity		Oil and grease	pH

North Coast	San Francisco Bay	Central Coast	Los Angeles	Central Valley	Lahontan	Colorado River	Santa Ana	San Diego
	Un-ionized ammonia		Polychlorinated biphenyls	Toxicity	Turbidity		Oxygen, dissolved	Phenolic compounds
	Population and community ecology		Priority pollutants	Suspended material	Suspended materials		pH	Radioactivity
			Radioactive substances		Non-degradation of aquatic communities and populations		Methylene blue-activated substances	Secondary drinking water standards
			Solid, suspended, or settleable materials				Sodium	Percent sodium and adjusted sodium adsorption ratio
			Taste and odor				Solids, suspended and settleable	Methylene blue-activated substances
			Temperature				Sulfate	Tastes and odors
			Toxicity				Sulfides	Temperature
			Turbidity				Surfactants	Total dissolved solids
							Taste and odor	Toxic pollutants
							Temperature	Toxicity
							Total dissolved solids	Trihalomethanes
							Total filterable residue	Turbidity
							Total inorganic nitrogen	Bacteria - total coliform, fecal coliform, e. coli, and enterococci
							Toxic substances	
							Turbidity	

IMPAIRED WATERBODIES

Section 303(d) of the Clean Water Act requires states to identify and develop a list of impaired waterbodies. The waterbodies on the list do not meet water quality standards. The state is required by EPA to prioritize the 303(d) list and to develop a Total Maximum Daily Load (TMDL), followed by an implementation plan, to improve water quality. States are required in even numbered years to review and update the 303(d) list. Further, under section 305(b) the State Water Resources Control Board (SWRCB) must report biannually to the EPA on the status of water quality across the State. Table 4.5-4 provides a summary of impaired waterbodies by Regional Board. Table 4.5-5 provides a tabular summary for each of the nine Regional Water Boards by pollutant category. A review of these tables and Figure 4.5-2 shows that the greatest extent of water quality impairments from forest activities is found in the North Coast (Region 1), the Lahontan Region (east side of the Sierra Nevada and Mojave Desert) (Region 6), and the Central Coast (Region 3). For rangeland, water quality impairments are also commonly occurring in the North Coast (Region 1), Lahontan (Region 6), and Central Coast (Region 3), as well as the Central Valley (Region 5). Typical water pollutants associated with forestry and range activities are sediment, water temperature, nutrients, and pathogens.

Table 4.5-4 Summary of impaired waterbodies by Regional Board Boundary.

Waterbody Size	North Coast	San Francisco	Central Coast	Los Angeles	Central Valley	Lahontan	Colorado River	San Gabriel	San Diego
Acres of Lake, Bays, and Estuaries	85706	3554626	67299	833041	708982	598212	1633422	40641	61035
Miles of Watercourses	47513	1538	8176	3646	11043	919	11920	612	2397

Table 4.5-5 Impaired waterbodies by generalized pollutant category and Regional Board boundaries. Acres reflect the size of lakes, bays and estuaries, whereas miles reflect the length of watercourses. Individual waterbodies may be listed for more than one pollutant.

Pollutant	Affected Size	North Coast	San Francisco	Central Coast	Los Angeles	Central Valley	Lahontan	Colorado River	San Gabriel	San Diego
Metals:	Acres	23453	621391	18096	16193	308365	123480	466680	6083	6202
	Miles	3282	64	368	474	2071	238	1614	193	28
Misc.:	Acres	29657	316916	2448	151104	55796			2865	6202
	Miles	2066	0	670	269	484			64	28
Nutrients:	Acres	199	141719	7687	2745	51139	227350	233340	9688	14325
	Miles	7697	184	1026	418	741	741	132	52	627
Other Inorganics:	Acres		54							1058
	Miles				175		27			48
Other Organics:	Acres	32150	1269558	385	171310	31413	31030		7358	2187
	Miles			99	116	333		1372	8	223
Pathogens:	Acres		11154	4523	175413	1635		233340	2187	2259
	Miles	662	197	1907	690	943	81.3	223	223	360
Pesticides:	Acres		955493	29760	175413	188080		466722	4883	1325
	Miles		512	1007	690	3410		7098	25	180
Salinity:	Acres		66339		29	28809	87978	233340		1058
	Miles	85		1531	418	370	195		21	185
Sediment:	Acres	247	8545	4129	344		87978		653	3660
	Miles	17366	203	791	101	28	120	1348	20	18
Temperature:	Acres									
	Miles	16355	76	269		441				
Toxicity:	Acres		47	155	163154	43742			6924	1319
	Miles		56	509	190	2220	60	66	6	10

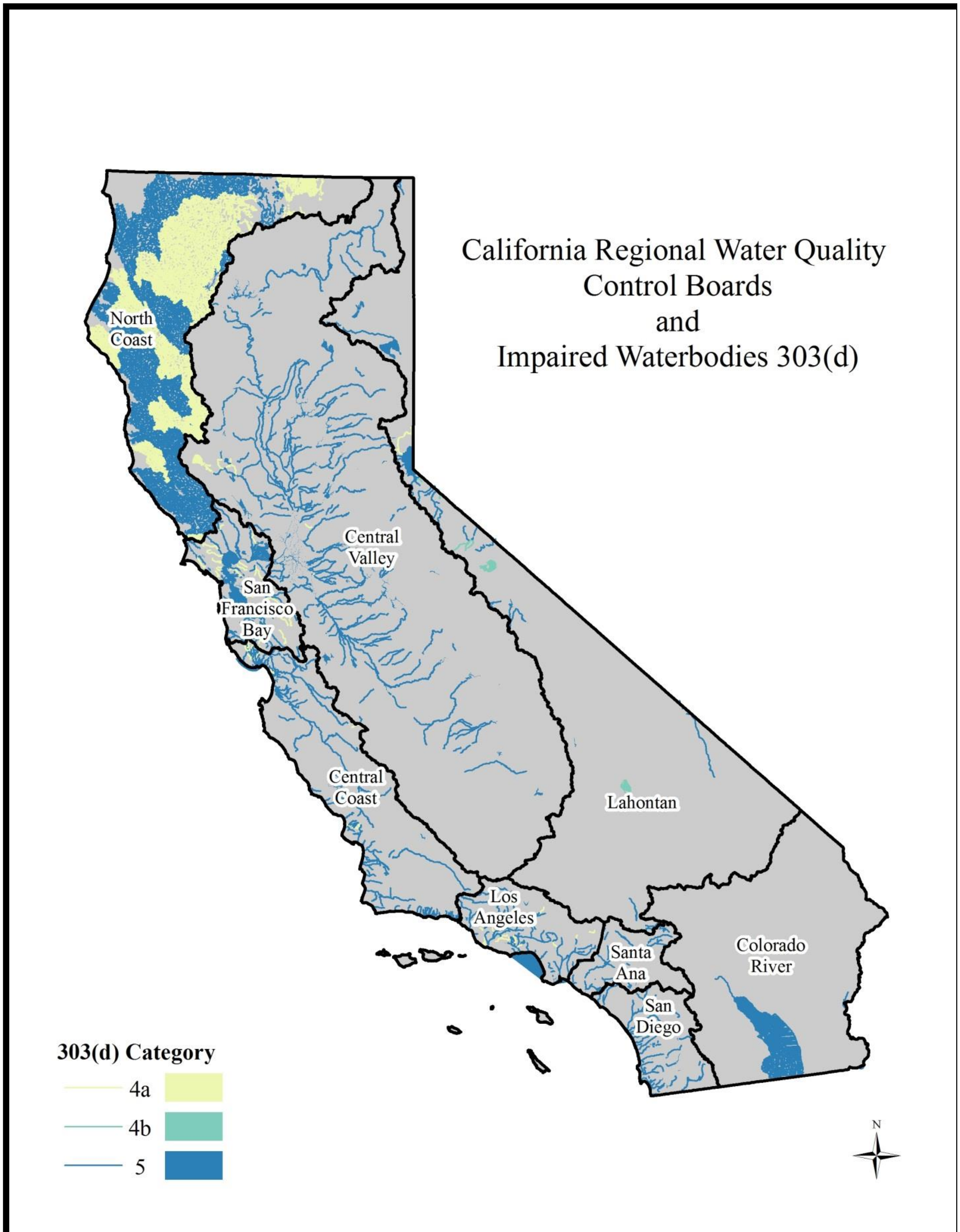


Figure 4.5-2 Impaired waterbodies by Regional Water Quality Control Board boundaries.

4.5.2 IMPACTS

4.5.2.1 SIGNIFICANCE CRITERIA

The following significance criteria have been developed based on the "Hydrology and Water Quality" sections of CEQA Appendix G: Environmental Checklist Form of the State CEQA Guidelines. The impact of the Program on water quality would be considered significant if projects that qualify for implementation under the proposed Process would:

- Violate any water quality standards or waste discharge requirements
- Would substantially degrade water quality

The significance criteria related to hydrology that typically fall under "Hydrology and Water Quality" in CEQA Appendix G are covered in Section 4.3.

Water quality objectives relevant to potential Program activities are generally narrative in nature. Temperature and turbidity are generally the only water quality objectives with numerical standards. Regardless of this, modeling water quality impacts is too difficult given the data requirements necessary for model simulations, resulting in questionable accuracy in model predictions (Zheng and Keller, 2006).

This analysis will consider the characteristic impacts of the various fuels reduction activities (e.g., mechanical, fire) on water quality within the context of the Program and associated alternatives. Characteristic impacts are evaluated through process-based knowledge of cause-and-effect linkages between potential vegetation treatment activities and various water quality constituents. Since roads are used to access the project areas, and roads are well-noted for impacting water quality (e.g., Luce and Wemple, 2001), roads are also considered in this analysis.

4.5.2.2 GENERALIZED WATER QUALITY IMPACTS OF FUELS REDUCTION ACTIVITIES

Table 4.5-6 summarizes water quality impacts of the various fuels reduction activities. It is assumed that the highest likelihood for significant impacts will occur from prescribed fire, mechanical, and herbivory treatments. Prescribed fire and mechanical impacts have the potential to significantly impact sediment and turbidity. The highest likelihood for impacts is in shrub-dominated landscapes, due to the higher potential for increased soil burn severity during prescribed burning. Significant increases in pathogens may occur if herbivory is implemented. Road use during project operations may also result in significant impacts to sediment and turbidity.

Table 4.5-6 Impacts to water quality from fuels reduction activities.

Activity	Water Quality Constituent	Impact Type
Prescribed Fire	Nutrients	Fire can disrupt nutrient cycling and cause nutrient leaching, volatilizing and transformation (Stednick, 2010). Several constituents can increase after forest and grassland burning and these include nitrate (NO_3^-), phosphate (PO_4^{3-}), calcium (CA^{2+}), magnesium (Mg^{2+}) and potassium (K^+). Phosphorus binds to sediment and loading typically occurs in conjunction with sediment delivery. Ammonium pulses may occur, but increased fluxes in nitrogen compounds are typically associated with nitrate. Increased nitrogen mineralization lasts for 1 year in grasslands, 2 years in shrublands, and up to 5 years in forested areas (Hobbs and Schimel, 1984; Wan et al., 2001). However, increases in available nitrogen do not always translate into increased fluxes in nitrate to waterbodies (Stephens et al., 2004). Water pH may increase (i.e., become acidic) when ash is delivered to watercourses (Stednick, 2010). Organic compounds leaching into surface waters can also affect water color, taste, and smell (Stednick, 2010). Measures that reduce on-site erosion and buffer zones will minimize the effects of fire on water quality (Stednick, 2010).
	Sediment, Settleable Material & Turbidity	The major factor determining the effect of prescribed fire on runoff and erosion is the amount of disturbance to surface organic material (Robichaud et al., 2010). Low burn severity only removes some of the litter/duff, whereas high burn severity can remove all of the soil cover and adversely impact soil structure. Bare mineral soil is exposed to rain splash and overland flow, and water repellency may form in some vegetation and soil types (Robichaud et al., 2010; Stednick, 2010). High burn severity can increase erosion rates by 2 to 3 orders of magnitude, whereas low and moderate burn severities have a much smaller effect on runoff and erosion. Prescribed burning in California's conifer forests have showed little to no increase in erosion (Biswell and Schultz, 1965; MacDonald et al., 2004), whereas burning in chaparral vegetation can increase erosion significantly (DeBano and Conrad, 1976). The higher rates of erosion in chaparral are due to the fact that prescribed fire in chaparral burns at higher intensity, removes more surface organic material, and has a higher likelihood for post-fire water repellency.
	Temperature	Soil heating can kill vegetation, leading to decreased shade. Prescribed fires may burn vegetation adjacent to watercourses, leading to greater inputs of solar radiation. Temperature increases will be greatest in smaller and shallower watercourses.
Mechanical	Nutrients	Mechanical removal of vegetation alters the nutrient cycle, and may increase nitrogen flux and loss via stream flow (Stednick 2010), although most of these impacts are associated with clear cutting. Phosphorus loading may increase due to the increased potential for soil erosion from mechanically disturbed sites. In general, nutrient mobility from treated areas follows the order: nitrogen > potassium > calcium and magnesium > phosphorus. Increases in nutrient mobility are largest following complete vegetation removal (e.g., clear cutting). However, impacts have been found to be minimal in most cases (Stednick, 2010). Impacts are reduced by minimizing the area of site disturbance and the use of streamside buffers (Stednick, 2010).
	Sediment, Settleable Material & Turbidity	Mechanical treatments that disturb soils may increase soil erosion. The magnitude and type of erosion affected by commercial mechanical treatments depends on the amount of soil exposed by the project activities, the erodibility of the soil, hillslope steepness, weather conditions, and whether there are any follow up activities after the initial disturbance (Swank et al., 1989). Non-commercial mechanical treatments can often time increase soil cover, which reduces runoff and erosion. Overall, few studies have been completed that look at the effect of non-commercial mechanical treatments on water quality (Stednick 2010), but those that have reveal minimal impacts (Hatchett et al. 2006). However, runoff and erosion is minimized by decreasing equipment passes, avoiding steep slopes, and scattering woody material onsite.
	Temperature	Water temperature can increase when streamside vegetation canopy is removed. Factors that determine the magnitude of temperature increase include watercourse width and discharge, distance from shade vegetation to the watercourse, stream orientation, height and density of vegetation, leaf area of canopy, latitude, date, and time (Quigley 1981). Retention of watercourse adjacent vegetation can mitigate potential temperature changes, especially temperature maximums and minimums (Stednick 2010).

Manual Hand Treatments	All constituents	Hand felling can be accomplished by one person with a chainsaw, and the amount of soil disturbance from this activity generally is considered negligible (Robichaud et al., 2010). A comparison of clear cut and thinned plots to control plots showed that hand-felling without mechanized yarding caused minimal surface disturbance and no increase in erosion (McClurkin et al., 1987).
Herbivory	Dissolved oxygen	Fecal material from grazing animals contains organic matter, which provides an energy source for aerobic bacteria in watercourses. Increased metabolism of the organic waste can result in oxygen depletion if the rate of depletion exceeds the aeration rate of the stream (Hubbard et al., 2004).
	Nutrients	Grazing removes vegetation, increases rain splash, decreases soil organic matter, increases surface crusting, decreases infiltration rates, and increases erosion. This can increase nutrient flux. Animal feces can act as sources of nitrate and phosphate. However, nutrient concentrations do not appear to increase under properly implemented grazing systems except in some riparian zones (Stednick 2010). Grazing under best management practices does not adversely affect water quality (Stednick, 2010).
	Pathogens	Animal activity along watercourses can affect the bacterial quality of the water. Animal feces may significantly increase the bacterial concentration of water. However, bacteria counts drop to background levels quickly after the animals are removed (Johnson et al. 1978). Recent studies in National Forest lands in California show that nitrate, total phosphorus, and phosphate concentrations exceeded EPA nutrient limits 0, 2, and <1 percent of the time (Roche et al., 2013). Fecal coliform limits were exceeded between 18-83 percent of the time, with the highest level of exceedances in the Lahontan Region (Roche et al., 2013). E. coli limits for contact recreation were exceeded between 6-29 percent of the time. Fecal coliform standards are mainly exceeded during storm events (Dahlgren et al. 2001)These results suggest cattle grazing, recreation, and clean water can be compatible goals across National Forest lands (Roche et al., 2013).
	Sediment, Settleable Material & Turbidity	Increased runoff and bare erodible soil (Stednick 2010) increase the likelihood of rain splash, sheet wash, and rill erosion. Animal trails/paths can concentrate runoff and initiate gullying (Trimble and Mendel 1995). This can lead to increases of suspended sediment and turbidity. Chiseling by cattle hooves can cause streambank erosion, but BMPs such as exclosure fencing along streams can limit this impact,
	Temperature	Grazing can reduce vegetative cover and shade, with a resulting increase in stream temperature (Beschta, 1997).
Herbicides	Pesticides	Vegetation control through the use of herbicides can be a fuel management activity if the targeted vegetation is a significant component of the fuel load. In the context of fuels treatments, herbicides are used infrequently and are often a one-time treatment (Stednick 2010). On National Forest lands, pesticides have not been detected in sufficiently high concentrations to affect drinking water (Michael 2000). Detections are typically associated with direct spray to surface waterbodies.
Roads	Sediment, Settleable Material & Turbidity	Road surfaces, cut slopes and fill slopes are subject to rain splash, sheetwash, rill, and gully erosion (Robichaud et al., 2010). Surface erosion increases during rainy conditions and with increased traffic. Gullies and rills can initiate below drainage structures. Streams can be diverted at road-stream crossings, and can cause extensive gullying when routed to unarmored hillslopes. Roads can increase the risk of landsliding (Reid, 2010). These impacts can increase suspended sediment and turbidity.

4.5.2.2.1 GENERALIZED WATER QUALITY IMPACTS BY REGIONAL WATER QUALITY CONTROL BOARD BOUNDARY

This water quality analysis uses the Regional Water Quality Control Board boundary as a hierarchical unit for analyzing impacts from the Program and the alternatives. Table 4.6-1 summarizes each Regional Water Quality Control Board with regard to precipitation and runoff regime, general water quality issues, and the potential for sediment-related water quality impacts.

Higher erosion rates drive higher sediment delivery rates (Megahan and Ketcheson, 1996), and therefore a higher potential for water quality impacts related to sediment, settleable material, and turbidity. In turn, these can affect beneficial uses such as: municipal and domestic water supply; cold and warm water fisheries; rare, threatened, and endangered species; migration of aquatic organisms; spawning, reproduction, and early development. Figure 4.5-3 shows the potential for surface erosion using the Revised Universal Soil Loss Equation (RUSLE) by Regional Water Quality Control Board boundary. The figure indicates that the potential for significant impacts from surface erosion are highest for the North Coast and Central Coast Water Quality Control Board Regions. Mountainous and/or steep areas of the Central Valley, San Francisco Bay, Los Angeles, Santa Ana, and San Diego Water Quality Control Board Regions are also potentially subject to higher rates of surface erosion. In general, the lowest potential for significant impacts attributed to surface erosion is in the Lahontan and Colorado River Water Quality Control Board Regions, although localized areas of high erosion potential occurs in these Regions.

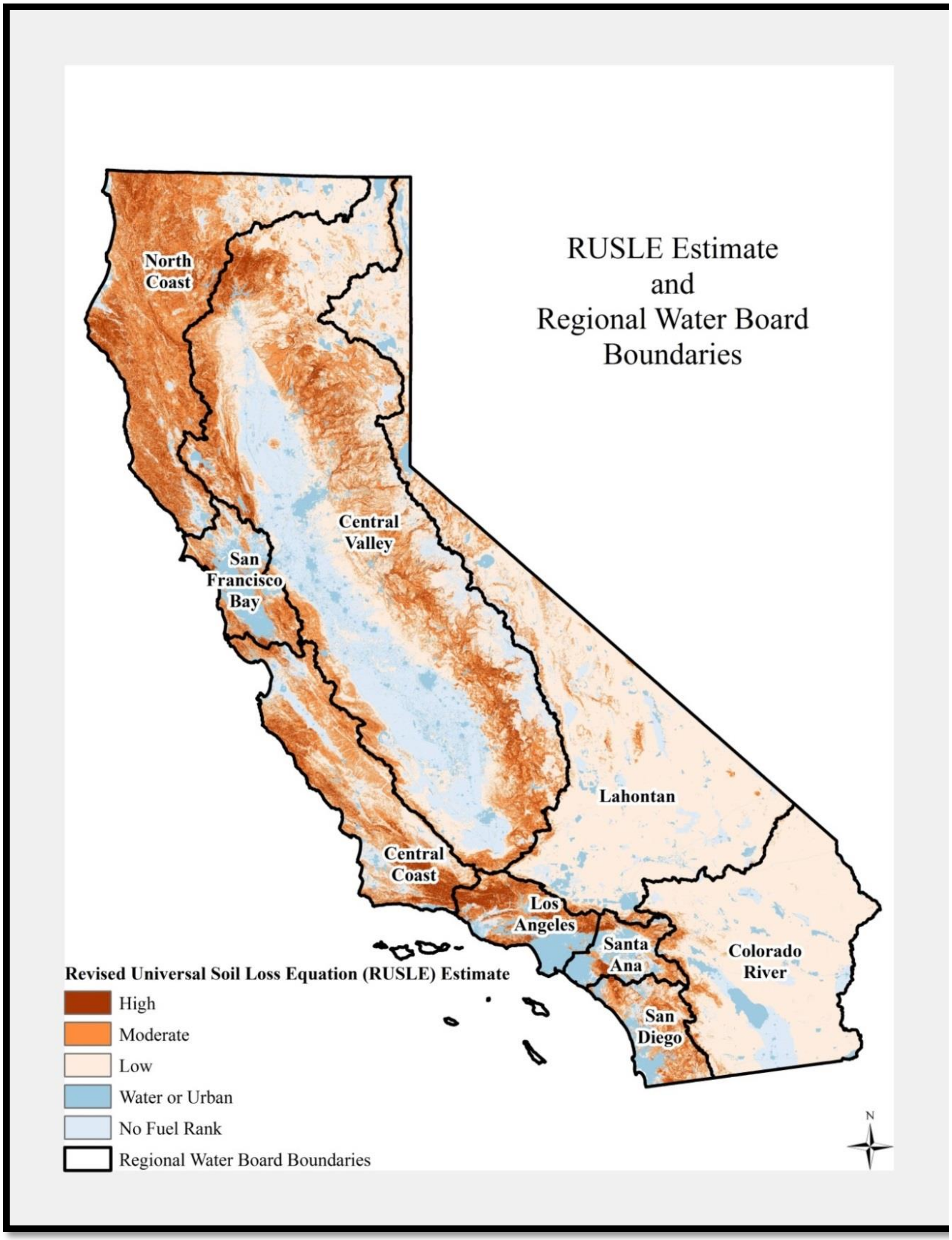


Figure 4.5-3 Estimated soil erosion using the Revised Universal Soil Loss Equation (RUSLE) by Regional Water Board boundaries. Low erosion varies from 1 to 8 tons per acre per year, moderate erosion varies from 9 to 50 tons per acre per year, and high is greater than 50 tons per acre per year.

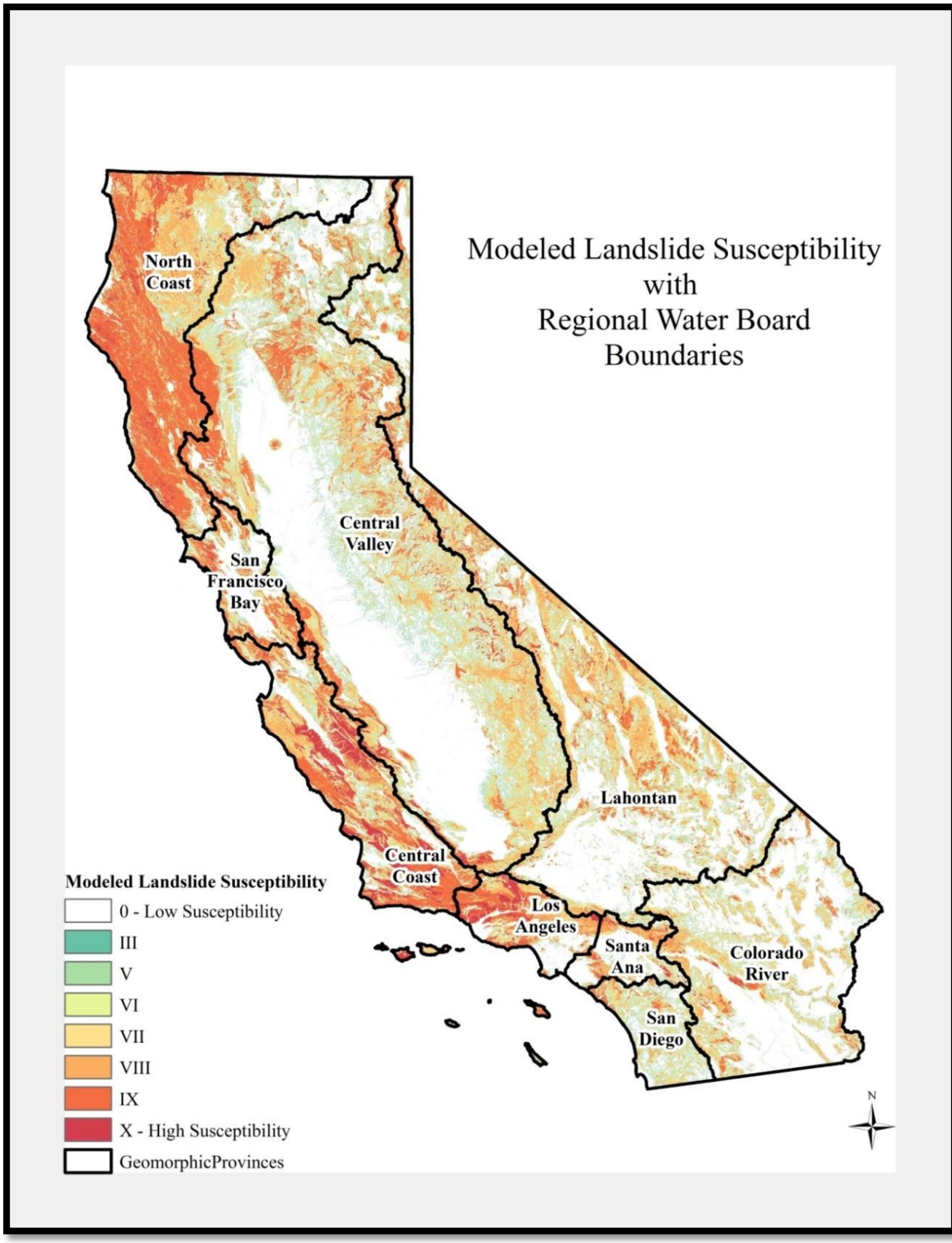


Figure 4.5-4 Modeled deep-seated landslide susceptibility by Regional Water Board boundary (CGS, 2011).

Landsliding can be an important cause of sediment-related water quality impacts in some areas (Neary et al., 2009). The potential for deep-seated landsliding is assessed using data from the California Geological Survey's Map Sheet 58 (CGS, 2011). The potential for deep-seated landsliding is highest in the North Coast, Central Coast, and Los Angeles Water Quality Control Board Regions (Figure 4.5-4). There is a moderate potential for deep-seated landsliding in the San Francisco Bay, Santa Ana, and Central Valley Water Quality Control Board Regions. In general, the lowest potential for deep-seated landsliding occurs in the San Diego, Colorado River, and Lahontan Regional Water Quality Control Board jurisdictions.

Figure 4.3-4 in the Geology, Hydrology, and Soils section shows the occurrence of slopes greater than 65 percent slope, and these slopes are generally more susceptible to shallow landsliding. Figure 4.3-4 indicates that the North Coast Water Quality Control Board Region has the highest abundance of slopes greater than 65 percent, and therefore the highest likelihood for water quality impacts related to shallow landsliding. Steeper, slide prone slopes also occur in mountainous portions of the other Water Quality Control Board Regions.

4.5.2.2.2 WATER QUALITY IMPACTS FROM THE PROGRAM AND ALTERNATIVES

Impacts from the Program and alternatives will be assessed by assuming implementation of SPRs and PSRs summarized in Table 4.5-7. In order to evaluate the potential for significant adverse impacts due to the Program and associated alternatives, it is necessary to determine which fuel reduction activity is most likely given the treatment type (i.e., WUI, fuel breaks, and ecological restoration) and vegetation type. To determine this, we surveyed CAL FIRE Registered Professional Foresters to determine which type of activity was most likely given a specific treatment and vegetation type (Table 4.5-8).

Results from the survey are shown in Table 4.5-8. In general, it shows that relatively more impactful prescribed burning will most likely be highly utilized for ecological restoration treatments in grass vegetation types, will be moderately utilized for fuel break and ecological restoration in forest vegetation, and moderately utilized for fuel break treatments in shrub vegetation. Mechanical treatments will be highly utilized for all treatment types in forest vegetation, and in WUI treatments in shrub vegetation types. Mechanical treatments will be moderately utilized for ecological restoration treatments in shrub vegetation types, and for WUI and fuel break treatments in grass vegetation types. Herbivory will most likely be used for fuel break and ecological restoration treatments in shrub and grass vegetation types (Table 4.5-8).

Table 4.5-7 Examples of SPRs and PSRs for each type of fuel reduction activity and water quality objective impact type. SPRs and PSRs from 4.4 and 4.5 will also be used to minimize water quality impacts to non-significance.

Activity	Impact Type	SPRs and PSRs to Minimize or Avoid Water Quality Impacts
All activities	Sediment, Settleable Material, Turbidity	Additional SPRs and PSRs to mitigate surface erosion and mass wasting related water quality impacts are found in Section 4.4.3.
Prescribed Fire	Nutrients, Sediment, Settleable Material, Turbidity, Temperature	A watercourse and lake protection zone (WLPZ) shall be established on each side of all Class I and II watercourses that is equal to the standard widths specified in the current CA Forest Practice Rules (Table 2.6.1). Fifty foot equipment limitation zones (ELZs) shall be established for Class III watercourses. Vegetation significant to maintenance of watercourse shade shall not be disturbed within Class I and II watercourses. Vegetation within and adjacent to Class III watercourses shall be retained, as feasible, to protect water quality, and additional equipment limitations recommended by the RWQCB shall be specified in the VTP Environmental Checklist as PSRs. Class IV watercourse protections shall be PSRs designed in conjunction with RWQCB staff. Buffers have been found effective in minimizing impacts from nutrients, sediment, and temperature from fuels treatments (Stednick, 2010).
		The potential impacts of prescribed fire on soil conditions (e.g., cover, water repellency, soil aggregate stability) will be mitigated by burning to achieve a low soil burn severity. The potential for management-induced runoff and erosion after low severity fire is relatively small (Robichaud et al., 2010).
		No direct ignition of project activity fuels shall be allowed within the WLPZs or ELZs. However, it is acceptable for backing fire to enter ELZs or WLPZs. Vegetation in buffers typically does not burn during prescribed fire operations due to higher soil moisture and live fuel moistures (Stednick, 2010).
		At the Calwater Planning Watershed scale, if the combined acreage subjected to mechanical fuel treatments, prescribed fire, and logging exceed 20% of the watershed area within a 10-year timespan, a hydrologic analysis will be performed to determine the potential for hydrologically-induced significant impacts. Keeping total treated acreage below this threshold will minimize peak flow increases to undetectable levels (Grant et al., 2008) and will theoretically minimize the likelihood of sedimentary impacts.
Roads	Sediment, Settleable Material, Turbidity	Compacted and/or bare linear treatment areas (e.g., fire breaks, roads, or skid trails) capable of generating storm runoff shall be drained via water breaks using the spacing guidelines contained in 14 CCR § 914.6 [934.6, 954.6] (c) of the California Forest Practice Rules. Frequent road drainage will minimize erosion and sediment delivery (MacDonald and Coe, 2008).
		Compacted and/or bare linear treatment areas and roads shall be drained such that they are hydrologically disconnected from watercourses or lakes. Measures to hydrologically disconnect these areas shall be guided by consulting with Technical Rule Addendum #5 of the California Forest Practice Rules – Guidance on Hydrologic Disconnection, Road Drainage, Minimization of Diversion Potential, and High Risk Crossings. Hydrological disconnection reduces sediment delivery (MacDonald and Coe, 2008).

Mechanical	Nutrients, Sediment, Settleable Material, Turbidity, Temperature	A watercourse and lake protection zone (WLPZ) shall be established on each side of all Class I and II watercourses that is equal to the standard widths specified in the current CA Forest Practice Rules (Table 2.6.1). Fifty foot equipment limitation zones (ELZs) shall be established for Class III watercourses. Vegetation significant to maintenance of watercourse shade shall not be disturbed within Class I and II watercourses. Vegetation within and adjacent to Class III watercourses shall be retained, as feasible, to protect water quality, and additional equipment limitations recommended by the RWQCB shall be specified in the VTP Environmental Checklist as PSRs. Class IV watercourse protections shall be PSRs designed in conjunction with RWQCB staff. Buffers have been found effective in minimizing impacts from nutrients, sediment, and temperature from fuels treatments (Stednick, 2010).
		Compacted and/or bare treatment areas shall be drained such that they are hydrologically disconnected from watercourses or lakes. Measures to hydrologically disconnect these areas shall be guided by consulting with Technical Rule Addendum #5 of the California Forest Practice Rules – Guidance on Hydrologic Disconnection, Road Drainage, Minimization of Diversion Potential, and High Risk Crossings. Hydrological disconnection reduces sediment delivery (MacDonald and Coe, 2008).
		At the Calwater Planning Watershed scale, if the combined acreage subjected to mechanical fuel treatments, prescribed fire, and logging exceed 20% of the watershed area within a 10-year timespan, a hydrologic analysis will be performed to determine the potential for hydrologically-induced significant impacts. Keeping total treated acreage below this threshold will minimize peak flow increases to undetectable levels (Grant et al., 2008) and will theoretically minimize the likelihood of sedimentary impacts.
	Oil and Grease	Prior to the start of onsite activities, all equipment will be inspected for leaks and regularly inspected thereafter until equipment is removed from the project area. All contaminated water, sludge, spill residue, or other hazardous compounds will be contained and disposed of outside the boundaries of the site, at a lawfully permitted or authorized destination.
		Staging areas shall be designated and located to prevent leakage of oil, hydraulic fluids, or other chemicals into watercourses or lakes.
		All heavy equipment parking, refueling, and service shall be conducted within designated areas outside of the WLPZ or ELZ.

Herbivory	Nutrients, Sediment, Settleable Material, Turbidity, Temperature	A watercourse and lake protection zone (WLPZ) shall be established on each side of all Class I and II watercourses that is equal to the standard widths specified in the current CA Forest Practice Rules (Table 2.6.1). Fifty foot equipment limitation zones (ELZs) shall be established for Class III watercourses. Vegetation significant to maintenance of watercourse shade shall not be disturbed within Class I and II watercourses. Vegetation within and adjacent to Class III watercourses shall be retained, as feasible, to protect water quality, and additional equipment limitations recommended by the RWQCB shall be specified in the VTP Environmental Checklist as PSRs. Class IV watercourse protections shall be PSRs designed in conjunction with RWQCB staff. Exclusion of animals from the WLPZ will minimize impacts to temperature and sediment-related water quality objectives. Buffers help to prevent impacts from sediment, nutrients, and temperature (Agouridis et al., 2005).
		Use of fencing, herding, and on-site water will minimize impacts (Trimble and Mendel, 1995; Hubbard et al., 2004).
Manual Hand Treatments	Nutrients, Sediment, Settleable Material, Turbidity, Temperature, Pathogens	A watercourse and lake protection zone (WLPZ) shall be established on each side of all Class I and II watercourses that is equal to the standard widths specified in the current CA Forest Practice Rules (Table 2.6.1). Fifty foot equipment limitation zones (ELZs) shall be established for Class III watercourses. Vegetation significant to maintenance of watercourse shade shall not be disturbed within Class I and II watercourses. Vegetation within and adjacent to Class III watercourses shall be retained, as feasible, to protect water quality, and additional equipment limitations recommended by the RWQCB shall be specified in the VTP Environmental Checklist as PSRs. Class IV watercourse protections shall be PSRs designed in conjunction with RWQCB staff. Buffers have been found effective in minimizing impacts from nutrients, sediment, and temperature from fuels treatments (Stednick, 2010).
		Compacted and/or bare linear treatment areas (e.g., fire breaks, roads, or trails) capable of generating storm runoff shall be drained via water breaks using the spacing guidelines contained in 14 CCR § 914.6 [934.6, 954.6] (c) of the California Forest Practice Rules. Frequent road drainage will minimize erosion and sediment delivery (MacDonald and Coe, 2008).

Herbicides	Pesticides	Prior to the start of herbicide treatment activities, CAL FIRE shall prepare a Spill Prevention and Response Plan (SPRP), pursuant to 40 CFR 112, for project coordinator approval to provide protection to onsite workers, the public, and the environment from accidental leaks or spills of vehicle fluids, herbicides, or other potential contaminants. This plan shall include (but not be limited to): a map that delineates VTP staging areas, where storage, loading, and mixing of herbicides and/or refueling, lubrication, and maintenance of equipment will occur; a list of items required in a spill kit onsite that will be maintained throughout the life of the project; procedures for the proper storage, use, and disposal of any solvents or other chemicals used in vegetation treatment; and identification of lawfully permitted or authorized disposal destinations outside of the project site. See Chapter 4.4.
		Applicators of herbicides shall follow all herbicide label requirements and refer to all other local, state, and federal regulations (including OSHA requirements) to protect sensitive resources and employee and public health during herbicide application. See Chapter 4.4.
		All pesticide use shall be implemented consistent with Pest Control recommendations prepared annually by a licensed Pest Control Advisor. See Chapter 4.4.
		All appropriate laws and regulations pertaining to the use of pesticides and safety standards for employees and the public, as governed by the EPA, the California Department of Pesticide Regulation (CDPR), and local jurisdictions shall be followed. All applications shall adhere to label directions for application rates and methods, storage, transportation, mixing, and container disposal. All contracted applicators shall be appropriately licensed by the state. CAL FIRE staff shall coordinate with the County Agricultural Commissioners, and all required licenses and permits shall be obtained prior to pesticide application. See Chapter 4.4.
		Herbicide applicators shall have or work under the direction of a person with a Qualified Applicator License or Qualified Applicator Certificate. See Chapter 4.4.
		CAL FIRE shall avoid herbicide treatment in areas adjacent to waterbodies, riparian areas, and primary drainage access per requirements set forth by CDPR. CAL FIRE shall follow all herbicide labels and directions in determining applications near water resources or riparian habitats and shall limit application to outside the WLPZ or greater than 50 feet for Class III and IV watercourses. Buffers will avoid direct spray of herbicides on surface waters, thereby minimizing impacts to water quality (Stednick, 2010)
		The following general application parameters shall be employed during herbicide use: application shall cease when weather parameters exceed label specifications, when wind at the site of application exceeds seven miles per hour (MPH), or when precipitation (rain) occurs or is forecasted with greater than a 40 percent probability in the next 24-hour period to prevent sediment and herbicides from entering the water via surface runoff; spray nozzles shall be configured to produce a relatively large droplet size; low nozzle pressures (30-70 pounds per square inch [PSI]) shall be observed; spray nozzles shall be kept within 24 inches of vegetation during spraying; drift avoidance measures shall be used to prevent drift in locations where target weeds and pests are in proximity to special-status species or their habitat. Such measures can consist of, but would not be limited to, the use of plastic shields around target weeds and pests, and adjusting the spray nozzles of application equipment to limit the spray area. See Chapter 4.4.
		All herbicide and adjuvant containers will be triple rinsed with clean water at an approved site, and the rinsate shall be disposed of by placing it in the batch tank for application. Used containers shall be punctured on the top and bottom to render them unusable, unless said containers are part of a manufacturer's container recycling program, in which case the manufacturer's instructions shall be followed. Disposal of non-recyclable containers will be at legal dumpsites. Equipment will not be cleaned and personnel will not bathe in a manner that allows contaminated water to directly enter any body of water within the treatment areas or adjacent watersheds. Disposal of all pesticides shall follow label requirements and local waste disposal regulations. See Chapter 4.4.
		All storage, loading, and mixing of herbicides will be set back at least 300 feet from any aquatic feature or special-status species or their habitat or sensitive natural communities. All mixing and transferring will occur within a contained area. Any transfer or mixing on the ground will be within containment pans or over protective tarps. See Chapter 4.4.

Table 4.5-8 The relative likelihood of using a fuel reduction activity type based on the desired treatment and dominant vegetation type. Likelihood determined through the averaging of surveyed CAL FIRE Registered Professional Foresters. L=Low likelihood; M=Moderate likelihood; H=High likelihood.

Activity	Forest			Shrub			Grass		
Type	WUI	Fuelbreak	Eco	WUI	Fuelbreak	Eco	WUI	Fuelbreak	Eco
Burning	L	M	M	L	M	L	M	M	H
Hand Treatments	H	M	M	M	M	M	L	L	L
Mechanical	H	H	H	H	L	M	M	M	L
Herbicide	M	M	L	L	M	L	L	L	L
Herbivory	L	L	L	L	M	L	L	M	M

The next step in evaluating the potential water quality impacts of the proposed Program and associated alternatives requires knowing which Water Quality Control Board Regions the projects will be located in. Knowing the treatable acreage under each treatment can also help to focus the impact assessment (Table 4.5-9), as the Alternatives are generally comprised of different combinations of the three treatment types. Figure 4.5-5 shows the treatable acreage by Regional Water Quality Control Board (Water Board) boundary and treatment type. Tables 4.5-10 through 4.5-12 show the treatable acreage by tree, shrub, and grass-dominated vegetation types, respectively.

Under the Proposed Program the highest likelihood for impacts will occur in the Central Valley and North Coast Water Quality Control Boards Regions. This is due to the relatively high acreage available for treatment in each Region (Table 4.5-9), with 10.7 and 5.2 million acres available for the Central Valley and North Coast Water Board Regions, respectively. Available areas for treatment also coincide with mountainous topography associated with the Sierra Nevada, Coast Ranges, Cascade Range, and Klamath Mountains. These areas generally have a higher inherent potential for sediment-related water quality impacts due to the combination of steeper slopes and higher rainfall (see Chapter 4.3). The North Coast Water Board Region also has the highest number of impaired waterbodies under the 303(d) list with the potential for linkage to likely VTP activities (e.g., sediment, temperature, etc.). This means the North Coast Water Board Region has the highest overall potential for impacts from the Proposed Program. However, 82 percent of the treatable acreage with the North Coast Region is in tree-dominated vegetation types in the ecological restoration and WUI treatment types (Tables 4.5-10 through 4.5-12), and treatment activities in this vegetation type are typically of lower intensity (ladder fuel removal) when related to water quality impacts. The Central Valley Water Board Region is dominated equally by tree and grass vegetation types (90 percent of treatable acres for both), and most of the treatable acreage is designated as WUI (47 percent) and ecological restoration (38 percent).

The Central Coast and Lahontan Water Board Regions have 3.2 and 2.1 million acres available for treatments, respectively (Table 4.5-9). The majority of the treatable area in the Central Coast Water Board Region is in grass-dominated vegetation types (69 percent), with most treatments identified as WUI (55 percent) or ecological restoration (30 percent). The Lahontan Water Board Region has the majority of its treatable area (71 percent) as shrub dominated vegetation (4.5-11), with almost an even split between WUI, fuel break, and ecological restoration treatments (Table 4.5-9).

Approximately 15 percent (3.8 million acres) of the total treatable area lies within the Colorado River (3.0 percent), Los Angeles (2.5 percent), San Diego (3.7 percent), San Francisco Bay (4.5 percent), and Santa Ana (1.5 percent) Water Quality Control Board Regions (Table 4.5-9). With the exception of the area covered by the San Francisco Bay Water Board, these Regions are dominated by shrub vegetation, ranging from 71 percent for the Santa Ana Water Board Region to 83 percent for the Colorado River Water Board Region (Tables 4.5-10 through 12). The San Francisco Bay Water Board Region is dominated by grass (53 percent) and tree (29 percent) vegetation types. More than 60 percent of the treatable lands in these Regions are identified as WUI treatments, although the Colorado River Water Board has the majority of treatable land classified as potential fuel break treatments (55 percent).

The Proposed Program proposes to treat 60,000 acres per year in a combination of WUI, fuel breaks, and ecological restoration treatments. By using Tables 4.5-10 through 4.5-12, and assuming that projects will occur in proportion to the area in a given Regional Board boundary, vegetation type, and treatment type, it is possible to determine how many projects are likely to occur in scenarios with a higher likelihood for water quality-related impacts. Approximately 21 projects per year have a high likelihood of utilizing burning in grass. The majority of projects utilizing prescribed fire in grass (i.e., ecological restoration) will be in the Central Valley Water Board Region, which is projected to have 14 projects of this type per year. There is a moderate likelihood of burning in shrub dominated vegetation for approximately 16 projects per year. Burning in shrub vegetation is projected to be predominantly limited to fuel breaks in the Lahontan, Colorado River, and Central Valley Water Board Regions. These provinces will account for approximately six, four, and two projects per year, respectively. Burning in forest vegetation types have a moderate likelihood of occurring in approximately 57 projects per year, with the majority occurring in the North Coast (n=25) and Central Valley Water Board Regions (n=26). Mechanical treatments have a high likelihood of occurring in 97 projects per year in forest vegetation types, primarily in the North Coast (n=40) and Central Valley (n=45) Water Board Regions. Projects with a higher likelihood of utilizing mechanical activities in shrub vegetation types will be associated with WUI treatments in the Central Valley Water Board (n=4), Lahontan Water Board (n=4), San Diego Water Board (n=4), Los Angeles Water Board (n=3), Central Coast Water Board (n=3), Colorado River Water Board (n=2), and Santa Ana Water Board Regions (n=2). There is a moderate likelihood that mechanical activities will be used on an additional 13 projects per year for ecological restoration in shrub lands, and 60 projects per year in grasslands (i.e., WUI and fuel breaks treatments).

Given the discussion above, the highest likelihood for significant water quality impacts will occur with prescribed fire and mechanical activities in portions of the North Coast, Central Coast, and Los Angeles Water Quality Control Board Regions dominated by shrub vegetation types. These activities have the potential to exceed water quality objectives for sediment, settleable material, and turbidity if not properly implemented. Exceedances related to sediment may also occur in waterbodies impaired for sediment. The use of herbivory in the Lahontan Water Quality Control Board Region also has a higher likelihood for significantly impacting water quality, due to the stringent requirements related to fecal coliform in this Region. In general, prescribed fire and mechanical treatments will have a higher likelihood for water quality impacts than other fuel reduction activities. The following discussion will make the determination of whether significant impacts to water quality standards (i.e., water quality objectives) would occur.

Impacts from the Proposed Program will be **less than significant** for sediment-related impacts (i.e., water quality objectives related to suspended sediment, settleable material, turbidity). This is due to the implementation of SPRs and PSRs that minimize soil disturbance, on-site erosion, and the potential for sediment delivery (Stednick, 2010). These SPRs include GEO-1, HYD-3, HYD-5, HYD-6, HYD-7, HYD-8, HYD-9, HYD-13, HYD-14, HYD-16, and HYD-17.

The Proposed Program will avoid prescription burning that will result in moderate to high soil burn severity (GEO-2), and will only allow backing fires into WLPZs and ELZs (HYD-4). The VTP Proposed Program also does not allow for road construction or reconstruction (HYD-13), which is a well noted source of sediment in wildland areas (Luce and Wemple, 2001). Proper drainage and hydrological disconnection of roads is also required within project areas (HYD-5 and HYD-6), thereby reducing sediment delivery from road surface erosion.

Impacts from the Proposed Program will be **less than significant** for nutrient-related impacts. The requirement for WLPZs and ELZs (HYD-3) and erosion control SPRs and PSRs will minimize impacts from prescribed fire (Stednick, 2010). Watercourse buffers are also effective in reducing nutrient impacts from mechanical activities (Stednick, 2010). The use of targeted grazing (HYD-17) along with the requirement for WLPZs and ELZs will also minimize nutrient-related impacts associated with herbivory.

Impacts from the Proposed Program will be **less than significant** for temperature-related impacts. Impacts are minimized due to the requirement for WLPZs. There will be no activities allowed in WLPZs with the exception of backing prescription fire. This will maintain the existing streamside vegetation, which is the key to maintaining watercourse temperature at existing levels (Stednick, 2010). The North Coast Water Quality Control Board Region has a high number of forested waterbodies 303-d listed for temperature. However, treatments associated with tree-dominated vegetation types will generally be understory fuel removal outside of the WLPZ. The general lack of overstory tree removal outside the WLPZs will also ensure that significant impacts will be avoided in temperature-listed forested waterbodies.

The impacts from the Proposed Program to water quality from oil and grease, herbicides, and other hazardous material will be **less than significant**. Impacts from oil, grease, and other hazardous material will be minimized through a combination of practices including routine equipment inspection and maintenance, and requirements for refueling, repair, and staging outside of WLPZs. Impacts from herbicides will be avoided through the prohibition of spraying within WLPZs (i.e., HAZ-8) (Stednick, 2010), and other spray-related SPRs and PSRs (see Hazardous Materials in Chapter 4.4).

The impacts from the Proposed Program to pathogen-related water quality impacts from herbivory will be **less than significant.** This is due to the use of WLPZs and the practice of targeted grazing. Together, these SPRs minimize pathogen-related impacts by directing grazing animals away from watercourses.

Altogether, the impacts from the Proposed Program will be **less than significant**. Required consultation with the affected Regional Water Quality Control Board will ensure that appropriate PSRs will be developed to avoid significant water quality impacts at the project scale.

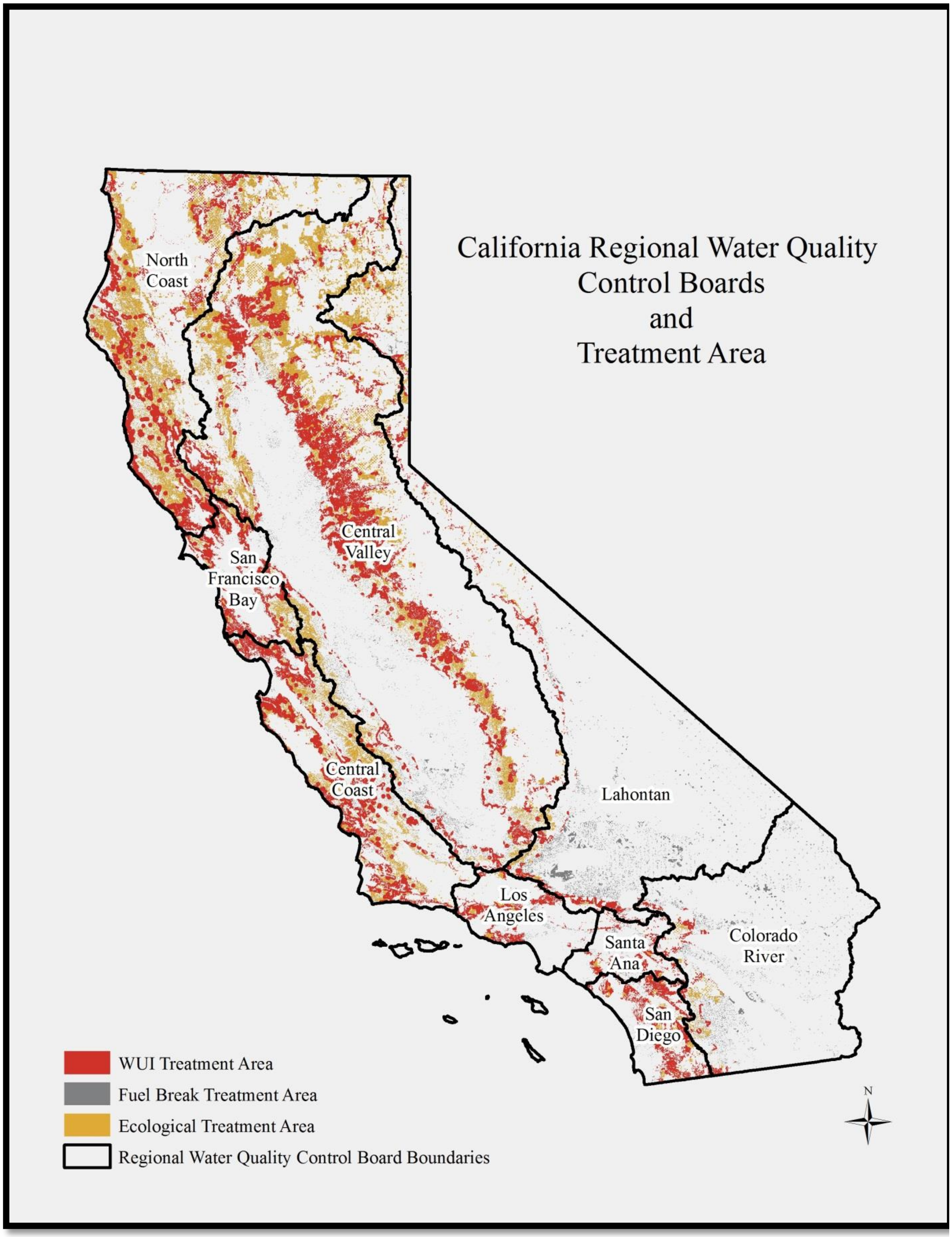


Figure 4.5-5 VTP treatments by Regional Water Quality Control Board boundaries.

Table 4.5-9 Treatable acreage by Water Board and treatment type under the Proposed Program.

WaterBoard	WUI	FUEL BREAK	ECO	Total by Water Board
Central Coast	1,741,767	482,436	941,326	3,165,529
Central Valley	5,027,006	1,616,366	4,080,764	10,724,136
Colorado River	200,340	399,209	133,171	732,720
Lahontan	615,742	753,990	682,514	2,052,246
Los Angeles	417,238	129,867	77,150	624,256
North Coast	2,091,812	723,639	2,338,177	5,153,628
San Diego	652,832	160,587	110,176	923,595
San Francisco Bay	717,403	172,761	228,958	1,119,122
Santa Ana	260,206	97,381	25,551	383,138
Total by Treatment	**11,724,346**	**4,536,236**	**8,617,786**	**24,878,369**

Table 4.5-10 Treatable tree-dominated acres under the Proposed Program.

WaterBoard	WUI	FUEL BREAK	ECO	Total by Water Board
Central Coast	176,216	26,094	58,477	260,788
Central Valley	2,015,063	525,853	2,260,768	4,801,685
Colorado River	21,483	17,694	76,914	116,092
Lahontan	165,443	71,845	267,170	504,457
Los Angeles	23,658	6,603	6,353	36,614
North Coast	1,551,809	544,849	2,175,501	4,272,159
San Diego	36,884	10,616	13,274	60,774
San Francisco Bay	208,321	41,132	75,399	324,852
Santa Ana	29,194	9,827	3,710	42,730
Total by Veg Type	**4,228,070**	**1,254,514**	**4,937,567**	**10,420,151**

Table 4.5-11 Treatable shrub-dominated acres under the Proposed Program.

WaterBoard	WUI	FUEL BREAK	ECO	Total by Water Board
Central Coast	339,301	108,156	270,940	718,397
Central Valley	485,114	183,483	384,974	1,053,570
Colorado River	171,970	379,045	55,026	606,041
Lahontan	400,913	661,216	394,054	1,456,184
Los Angeles	295,588	97,499	58,983	452,069
North Coast	148,073	62,719	130,289	341,081
San Diego	477,079	120,708	78,425	676,211
San Francisco Bay	129,412	33,964	37,677	201,053
Santa Ana	181,074	68,175	21,341	270,590
Total by Veg Type	**2,628,524**	**1,714,965**	**1,431,708**	**5,775,197**

Table 4.5-12 Treatable grass-dominated acres under the Proposed Program.

WaterBoard	WUI	FUEL BREAK	ECO	Total by Water Board
Central Coast	1,226,250	348,186	611,908	2,186,344
Central Valley	2,526,829	907,030	1,435,022	4,868,881
Colorado River	6,886	2,470	1,231	10,587
Lahontan	49,386	20,929	21,290	91,605
Los Angeles	97,993	25,765	11,814	135,573
North Coast	391,930	116,070	32,387	540,388
San Diego	138,870	29,263	18,477	186,609
San Francisco Bay	379,670	97,666	115,882	593,217
Santa Ana	49,938	19,379	500	69,818
Total by Veg Type	**4,867,752**	**1,566,758**	**2,248,511**	**8,683,021**

NO PROJECT

The “No Project” alternative is expected to have fewer impacts than the Proposed Program. This is primarily because the project acreage under this alternative is less than half of that under the Proposed Program (i.e., 27,000 acres per year; 104 projects per year). On a unit acre basis, the “No Project” alternative might be more impactful due to the fact that there are fewer best management practices utilized than those specified by the Proposed Program. Historically, the VMP relied on burning for 50 percent of its treatments, and burning is generally more impactful than most other forms of fuel reduction activities. However, fewer treated acres will generally result in fewer potential impacts. **The No Project alternative would result in no significant impacts to water quality.**

ALTERNATIVE A

Alternative A proposes to treat 60,000 acres per year solely in the WUI treatment type. This alternative will more than double the number of projects in the WUI from 108 projects per year to 231 projects per year. The same SPRs and PSRs will be utilized as in the Proposed Program. In general, WUI treatments will seldom utilize prescribed burning in shrub and forest-dominated vegetation, and will place an increased emphasis on mechanical and hand treatments in these areas. As such, fewer impacts from prescribed fire will occur using this alternative, but impacts from mechanical activities will increase. It is expected that impacts from Alternative A will be slightly less than those in the Proposed Program, despite the same amount of area being treated. **Alternative A would result in no significant impacts to water quality.**

ALTERNATIVE B

Alternative B would treat 60,000 acres per year between the WUI and fuel breaks treatment type. Projects in the WUI are projected to be 36 percent higher than the Proposed Program (n=147), and projects utilizing fuel breaks treatments are expected to increase by 80 percent relative to the Proposed Program. Burning for fuel breaks treatments in shrub dominated areas is expected to rise by 50 percent, and in general the use of mechanized fuel reduction activities will increase due to the increased focus on WUI and fuel breaks. It is expected that impacts from Alternative B will be comparable to those projected from the Proposed Program, with a slight increase in impacts to shrub dominated areas subjected to fuel breaks treatments. **Alternative B would result in no significant impacts to water quality.**

ALTERNATIVE C

Alternative C treats 60,000 acres per year in Very High Fire Hazard Severity Zones (VHFHSZ) only. This alternative utilizes all fuel reduction activities to achieve fuel hazard reduction. While this alternative treats the same acreage annually as the Proposed Program, Alternative A, and Alternative B, the distribution of VHFHSZ is more dispersed in nature. Dispersing activities will theoretically lessen impacts to geologic, hydrologic, and soil resources. As such, this alternative will have slightly less impact than the Proposed Program. **Alternative C would result in no significant impacts to water quality.**

ALTERNATIVE D

Alternative D treats 36,000 acres per year, but limits prescribed fire to only 6,000 acres annually. As such, this alternative would rely on mechanical, herbicide, hand treatment, and herbivory activities to implement WUI, fuel breaks, and ecological restoration treatments. The scale of this alternative is smaller than Alternatives A, B, or C, and therefore the potential for significant impacts is the lowest of any alternative other than the “no project” alternative. **Alternative D would result in no significant impacts to water quality.**

4.5.3 MITIGATION AND STANDARD PROJECT REQUIREMENTS

Under this analysis there are no additional mitigations. SPRs and PSRs that are relevant to water quality are listed in the Chapters 4.3.3 and 4.4.3.

4.6 ARCHAEOLOGICAL, CULTURAL AND HISTORIC RESOURCES

This section addresses the archaeological, cultural, and historic environment that the impacts of the proposed project will be evaluated in context of. The material presented in 4.6 has been broken into three sections:

- **4.6.1 – Affected Environment**
  - The Affected Environment section discusses the regulatory framework that addresses the protection of archaeological, cultural, and historic environment that may be impacted by the proposed Program or Alternatives and an overview of California’s prehistoric, ethnographic and historic settlement patterns.
- **4.6.2 – Effects**
  - The Effects section outlines the potential impacts of implementing the proposed Program and the Alternatives.
- **4.6.3 – Mitigations**
  - The Mitigation section provides the standard program requirements and project specific requirements that will reduce the likelihood of the proposed Program causing significant adverse impacts to archaeological, cultural, and historic resources.

4.6.1 AFFECTED ENVIRONMENT

The following discussion of the prehistoric, ethnographic, and historic background provides a context for identifying the variety of artifacts and features that may be affected by the proposed Vegetation Treatment Program (VTP).

- Prehistoric Native American archaeological sites predating sustained Euro-American settlement in 1850.
- Historic districts as defined in Public Resources Code Section 5020.1(h), “a definable unified geographic entity that possesses a significant concentration,

linkage, or continuity of sites, buildings, structures, or objects united historically or aesthetically by plan or physical development."

- Historic archaeological sites typically dating from the period 1850-1964 (50 years of age is the general threshold for recognition of historic period resources).
- Historic period architectural features older than 50 years, such as building and structures.
- Traditional cultural places important to contemporary Native Americans who have heritage ties to the land.

4.6.1.1 **Regulatory Framework**

The California Environmental Quality Act (CEQA) and the National Environmental Policy Act (NEPA) recognize that only those heritage resources determined per the respective state or federal criteria to be "significant" qualify for consideration of impacts in environmental impact analyses. The management of archaeological and historical resources for the VTP is designed to comply with requirements of CEQA (as amended), the State CEQA Guidelines, the Public Resources Code (Section 5020 et. seq.), the California Register of Historic Resources (14 CCR § 4850 et seq.), Executive Order W-26-92, and to conform with established CAL FIRE procedures (Foster and Pollack, 2010).

CEQA requires that state agencies must identify and examine significant adverse environmental effects on archaeological and historical resources before approving most discretionary projects. CEQA provides statutory requirements for establishing the significance of archaeological resources (Section 21083.2) and historical resources (Section 21084.1).

CEQA defines a significant heritage resource as a resource listed or eligible for listing on the California Register of Historical Resources (CRHR) (PRC §15064.5(a)(1)). For a heritage resource to be eligible for listing in the CRHR, it must meet one or more of the following criteria (PRC 5024.1(c)):

1) Is associated with events that have made a significant contribution to the broad patterns of California's history or cultural heritage;
2) Is associated with the lives of persons important in our past;
3) Embodies the distinctive characteristics of a type, period, region, or method of construction, or represents the work of an important creative individual, or possesses high artistic values; or
4) Has yielded, or has the potential to yield, information important in prehistory or history.

Heritage resources determined eligible for or listed on the National Register of Historic Places (NRHP) are automatically included on the CRHR. The CRHR criteria are similar to those of the NRHP (36 CRF 60.4).

The California Forest Practice Rules (14 CCR 895.1, Definitions) reflect the criteria defined for the CRHP and the NRHP, as follows:

- *"Significant archaeological or historic site" means a specific location that may contain artifacts or objects, and where evidence clearly demonstrates a high probability that the site meets one or more of the following criteria:*

1) *Contains information needed to answer important scientific research questions;*
2) *Has a special and particular quality such as the oldest of its type or best available example of its type;*
3) *Is directly associated with a scientifically recognized important prehistoric or historic event or person;*
4) *Involves important research questions that historical research has shown can be answered only with archaeological methods; or*
5) *Has significant cultural or religious importance to Native Americans as defined in 14 CCR Section 895.1.*

These criteria must be addressed when evaluating the significance of archaeological and historical resources under CEQA. The important aspect of this evaluation process is the identification of the characteristics held by the resource that qualifies it as being significant. These identified characteristics provide the basis for establishing whether or not a proposed project will cause a substantial adverse change to that resource.

Archaeological and historical resources that are not deemed significant through formal evaluation must be noted in the initial study or project-level EIR (if one is prepared) along with the project effect, but need not be considered further in the CEQA process.

4.6.1.2 **Prehistoric California Background**

As a generalization, prehistoric California was settled during five distinct periods. Fredrickson (1974) identified these as the Paleo-Indian period (10,000 to 6,000 B.C.), the Lower Archaic period (6,000 to 3,000 B.C.), the Middle Archaic Period (3,000 to 1,000 B.C.), the Upper Archaic Period (1,000 B.C. to A.D. 500), and the Emergent period (A.D. 500-1,800). The discussion of these periods that follows below is adapted from Fredrickson (1974).

The first demonstrated entry and spread of humans into California took place during the Paleo-Indian period (10,000 to 6,000 B.C.). Social units during this period are thought to have been small and highly mobile; rather than exchanging resources with other social groups, the group moved to obtain needed resources. Sites have been identified in deposits under deep accumulations of recent alluvium along ancient pluvial lakeshores and coast lines. A summary of Paleo-Indian assemblages (Dillon, 1995) has shown sites from this period distributed throughout the state, often as surface deposits on arid, brush-covered slopes typical of areas treated under the VTP. These sites contain such characteristic hunting implements as the fluted projectile point and chipped stone crescentic. The period's characteristic artifacts also occur as isolated finds along ancient lake shores (such as Borax, Tulare, and Buena Vista Lakes) and in other highly eroded contexts.

The beginning of the Lower Archaic period (6,000 to 3,000 B.C.) coincides with that of the climatic change during the mid-Holocene to generally drier conditions that caused the pluvial lakes to dry up. The hunter-gatherer populations of this period were composed of small, mobile social groups that foraged for subsistence and economic resources across a broad landscape. These populations focused on exploiting large game animals and plant communities that yielded abundant small, hard seeds. Distinctive artifact types are large dart points and the milling slab and handstone. Sites from this period have been found throughout the state. In the Central Coast and Southern California geographic regions, sites can occur as large, deep middens most notably containing burials furnished with shell beads and milling stones. Sites distinguished by large, square-stemmed points and the milling stone and handstone assemblage in the North Coast geographic region occur in the valleys and on high-elevation ridges and passes.

The Middle Archaic Period (3,000 to 1,000 B.C.) begins when the mid-Holocene climatic conditions became similar to those of the present. Sedentism appears to have become more fully developed along with general population growth and expansion. Broad regional patterns of foraging subsistence strategies give way to more intensive procurement strategies, possibly with the introduction of acorn processing technology, which is evidenced by infrequent occurrences of the bowl mortar and pestle. This shift in procurement strategies is manifest throughout the state with the establishment of year-round inhabited villages at the confluences of major waterways. Local variants of the cultures initiated in the previous period persist in marginal and upland areas throughout the state.

The growth of sociopolitical complexity marks the beginning of the Upper Archaic Period (1,000 B.C. to A.D. 500), including the development of status distinctions, greater complexity of exchange systems, and further development of sedentary settlement systems. This period retains the large dart points in different styles, but the bowl mortar and pestle replace the milling stone and handstone throughout most of the state. In the Shasta-Sierra geographic region and interior portions of the North Coast and Central Coast geographic regions, permanent villages are established in the foothills and large seasonal camps are established in higher elevations to take advantage of varied resources. A similar pattern is present along the coast in the North Coast, Central Coast, and Southern California geographic regions, where the populations emphasized both marine and terrestrial resources in their subsistence strategy, resulting eventually in a greater settlement of the interior valleys. Rock art first appears in this period, occurring as petroglyphs associated with hunting practices and territorial boundary definition in the Modoc and Southern California geographic regions and the southern portion of the Shasta-Sierra geographic region.

The Emergent period (A.D. 500 to 1,800) is distinguished by several technological and social changes. The bow and arrow are introduced, ultimately replacing the dart and atlatl. Territorial boundaries between groups are well established and exchange of goods between groups becomes more regularized. Petroglyph and pictograph rock art become manifest in the Southern California geographic region and in portions of the Central Coast and Shasta-Sierra geographic regions. In the latter portion of this period (A.D. 1,500 to 1,800), exchange relations become highly regularized and sophisticated, with specialists governing various aspects of production and exchange. Pottery appears in quantity for the first time in the Southern California geographic region.

Throughout the state, large organized villages in complex ecological zones are complemented by many smaller satellite villages situated in adjoining, less diverse ecological settings (e.g., tributary streams and creek valleys). These diverse village complexes are complemented by many smaller sites used for special purposes, such as acorn processing, shellfish collecting, stone quarrying, and ritual activities. Small task-specific groups continue to obtain seasonally available resources in higher elevations. Within the Shasta-Sierra geographic region and interior portions of the North Coast and Central Coast geographic regions, entire populations moved from their foothill villages during summer to seasonal camps in the mountains. In the Modoc geographic region, permanent villages are established in the valleys between major hills and mountains while the uplands remain the loci of special-purpose sites.

GENERAL TYPES OF PREHISTORIC RESOURCES

The following are general prehistoric resource types that may be present in areas treated under the VTP. Terms and definitions are adopted from Dillon (1997).

Village Site: Village sites are locations of continuous and concentrated habitation generally situated close to a source of fresh water and resource abundant ecological zones. These sites typically have a large, well-developed midden deposit containing abundant artifactual (flaked stone tools and debitage, ground and battered stone, bone, and shell) and ecofactual (floral, faunal, and molluscan) evidence. They may also contain burials, rock art, bedrock milling stations, or other features.

Temporary Camp Site: Temporary camp sites are locations occupied for short periods and generally display the same variety of cultural remains as village sites. Their deposits tend to be shallow, contain few artifacts, and have a poorly developed midden soil. Features and burials are normally few and isolated.

Burial Site: A burial site or cemetery is a location where intentional human interments are found in large numbers and close concentration. These locations typically lack evidence of other prehistoric activities.

Milling Site: This is a boulder or group of boulders or bedrock outcrops that contain at least one modified surface (mortar, slick, or metate) caused by the processing of food or other natural resources.

Quarry Site: A quarry is a geological deposit from which rock and mineral materials were extracted, leaving evidence of the extractive activities.

Lithic Workshop: A lithic workshop is a distribution of stone flakes and tool fragments reflecting purposeful modification of parent stone through percussion and/or pressure detachment. These sites typically have a shallow deposit.

Ceramic Scatter: A ceramic scatter consists of fragments of ceramic vessels and artifacts distributed over generally open, flat ground.

Shell Middens: Shell middens are locations with large amounts of marine shell that extend to an appreciable depth below ground surface. They are normally found in coastal contexts but are also present in fewer numbers in the interior.

Shell Scatter: Shell scatters contain small amounts of marine shell, generally limited to the ground surface, and lack other associated artifacts.

Rock Art: Rock art consists of designs or design elements on rock surfaces created by surface applications (pictographs) or by pecking or etching (petroglyphs). These are found on non-portable surfaces such as boulders, cave walls, or cliff walls.

Rock Shelters: These are natural caves or crevices in rock outcrops in which human use has left artifactual remains.

4.6.1.3 Ethnographic Background

California Native American societies and cultures were remarkably diverse in their adaptations to the immense variety of environmental conditions throughout the state. Landforms and hydrographic features of every description, the great numbers of plant and animal species, and varied climatic conditions produced microenvironments of immense variety and resource potential. The Native Americans were intimately familiar with their immediate environment and relied almost totally on natural resources. An estimated 300,000 people who spoke 90 separate languages, including hundreds of dialects, inhabited the state before historic-period contact.

Excluding cultures adapted to the desert region of California, three of the four major Native American culture regions are within portions of the state proposed for implementation of the VTP. At the northern end of the North Coast geographic region, adaptations were focused along deep and narrow river systems. Hamlets of 25-75 residents subsisted primarily by fishing for salmon, collecting shellfish, and gathering acorn. Native Americans also hunted for deer, elk, and sea mammals. In the Shasta-Sierra geographic region, the vast waterways of the valley and foothills supported communities ranging from 10-15 to several hundred inhabitants. Acorns were the staple food, but the diverse subsistence base also comprised of deer, elk, antelope, fish, waterfowl, and many plants. The Modoc geographic region and interior portions of the North Coast and Central Coast geographic regions offered similar subsistence resources but supported lower population densities. Along the coast of the Southern California geographic region and a portion of the Central Coast geographic region, subsistence strategies emphasized marine fishing, shellfish collecting, sea mammal hunting, and gathering of terrestrial resources. This maritime-based adaptation supported villages of as many as 1,000 people.

The principal settlements in each of these cultural regions were situated near sources of fresh water, generally along the coast, rivers, or major creeks or at springs. These settlements were generally established within grassland and woodland environments that contained abundant food resources exploited by the Native American groups. These environments are also the most likely to be treated under the VTP. Areas within conifer forest environments that were distant from sources of water generally did not support permanent settlements, but Native American groups visited or occupied these areas on a seasonal basis to gather available resources. Areas with high mountains, dense timber, rolling hills, and open plains also were not conducive to permanent settlements. Special features of the environment, such as a mountain peak, prominent rock outcrop, or particular bend in a stream, sometimes held special meaning in spiritual beliefs or myths of Native American groups.

GENERAL TYPES OF ETHNOGRAPHIC/CONTEMPORARY NATIVE AMERICAN RESOURCES

Resource Collection Location: This is a location where Native Americans have historically gone, and are known or believed to go today, to collect resources in accordance with traditional cultural rules of practice.

Spiritual Location: This is a location where Native American religious practitioners have historically gone, and are known or believed to go today, to perform ceremonial activities in accordance with traditional cultural rules of practice.

Traditional Location: This is a location associated with the traditional beliefs of a Native American group about its origins, its cultural history, or the nature of the world.

Cemetery: A cemetery is a location that has been selected for human burial or interment.

4.6.1.4 Historic Background

The post-contact history of California can be viewed as a succession of four periods that have left physical traces on the modern landscape. These are the Hispanic era (1542 to 1846), the Early American period (1847 to 1879), Settlement and Growth (1880 to 1929), and the Depression period (1930 to 1941). A discussion of each period follows.

The Hispanic era (1542-1846) can be subdivided into the Spanish and Mexican periods based on political history. Early coastal explorations left little trace in the archaeological record. Formal colonization began in 1769 with the construction of a mission and presidio (fort) at San Diego. Franciscan friars established a chain of 21 missions in Alta (or "Upper") California that extended along the western margin of the North Coast, Central Coast, and Southern California regions from San Diego to Sonoma. Mission buildings were clustered generally in a quadrangle form, although several missions established outlying agricultural and ranching outposts within a half-day's journey on foot. Many of the early trails used for delivering supplies were prehistoric trade routes adopted by the Spanish and, later, the Mexicans.

The Russian-American Company established a southern outpost for its Alaskan fur trading operations along the coast of the North Coast geographic region from 1805 to 1841. The post was established to exploit the numerous sea otter populations and to furnish food for the Alaskan installations, which were in desperate need of fresh fruits and vegetables. Their initial settlement was established at Bodega Bay, but a permanent site for settlement was established at present-day Fort Ross in 1812. Agriculture, fruit orchards, and stock raising developed around Ross, but the area was not well suited to agriculture and farms were established in the interior valleys. The colony never prospered, and the settlement was abandoned with the sale of moveable properties to John Sutter in 1841.

After 1822, the Mexican government administered California and granted lands to citizens as a reward for services. Settlers engaging in the lucrative hide and tallow trade established outlying ranchos, often building adobe structures, barns, fences, and other improvements. The grants were mostly along the coast and around San Francisco Bay within the North Coast, Central Coast, and Southern California geographic regions, but some extended into Mendocino County and up the Central Valley to Redding. This type of settlement produced a rural, agrarian lifestyle that was disrupted in 1848 with the discovery of gold at Sutter's Mill and the subsequent influx of people.

The Early American period (1847-1879) had its origins as early as the 1820s when Euro-Americans began to filter into California. With the discovery of gold at Sutter's Mill near Sacramento in 1849, California's Euro-American population grew; settlers established regular exchange routes and sold their surplus goods to newly arriving immigrants. Mining activities, mostly in the North Coast and Shasta-Sierra regions, have left behind many archaeological features, including pits, hydraulic cuts, shafts, and (probably most common) water conveyance systems (e.g., ditches, canals, and flumes).

Small towns grew up throughout these two regions to serve the needs of miners with mercantile stores, blacksmith shops, restaurants, hotels, and saloons. Churches and schools soon followed. Under the Homestead Act of 1862, 160-acre farms were made available on unappropriated public land. Homesteaders settled in all portions of the state in areas with abundant water and grazing lands. Agriculture, logging, and transportation systems also developed but were limited largely to local enterprises that relied on human and animal power. The ranching industry continued to dominate the economy of the Southern California region.

Settlement and growth of transportation systems were the focus of the period from 1880 to 1929. During the first decades of this period, cycles of economic boom and bust occurred as California's population and the number of economic enterprises continued to increase. Economic growth was aided by the development of new power sources for machinery. The completion of the Transcontinental Railroad in 1869, powered by the steam locomotive, stimulated construction of railway lines across the state during the next two decades. These lines provided the means to connect California agriculture and industry with markets in the east. Other large-scale enterprises such as logging, electrical power generation, and irrigation systems were undertaken in mountainous, forested portions of the state. These endeavors employed large numbers of workers, at least for initial project construction, and therefore required work camps, employee housing areas, workshops, logistical centers, and transportation networks.

Urban centers along the railroads became more important, although rural patterns for homesteading and agricultural enterprises were also well established throughout the state. The pervasive pattern of small-scale settlements, including farms and ranches, has resulted in building and structure foundations, trash dumps, and the remains of ranching and irrigation systems. In the latter part of this period, the development of the gasoline-powered automobile and its ability to attain higher speeds initiated the development of paved highway systems throughout the state.

During the Depression period (1930-1941), the Civilian Conservation Corps and the Works Progress Administration performed an unprecedented amount of infrastructure construction (e.g., sidewalks, sewer lines, roads, and dams) throughout the nation. Both agencies set up many temporary camps across California. Gold mining increased, primarily from small-scale lode mines. Some larger companies operated bucket-line and drag-line dredges. These mines primarily used existing water conveyance systems built in the previous decades, and they frequently reworked tailings piles left over from hydraulic mining activities of the 1870s and 1880s.

GENERAL TYPES OF HISTORIC-PERIOD RESOURCES-GENERAL DEFINITION OF TERMS

Buildings: A building is a structure created to shelter any form of human activity (e.g., house, barn, church, and hotel).

Structure: A structure is a work made up of interdependent and interrelated parts in a definite pattern of organization. Constructed by humans, it is often an engineering project or large in scale (e.g., bridges, dams, lighthouses, water towers, radio telescopes).

Foundation: These are structural footings or lineal alignments made from wood, brick, or rock to support a building or structure.

Landscaping: This constitutes evidence of modification to the ground surface through such activities as contouring the land or planting vegetation (e.g., hedgerow, orchards, terraces, ponds).

Refuse Deposit: These are discrete areas such as ground surface, drainage embankments, earth pits, or other receptacles that contain artifact concentrations of glass, ceramic, metal, bone, or other material reflecting the purposeful discard of those materials (e.g., privies, dumps, trash scatters).

Linear Resource: Linear resources are mostly long, narrow constructions, either depressed, elevated, or at ground level. These include any device constructed to transport water (e.g., flumes, pipes, ditches, canals, dams, and tunnels), corridors designed to facilitate the transportation of people, vehicles, or information (e.g., roads, trails, railroad grades, and telegraph/telephone lines), and barriers constructed to separate adjoining areas (e.g., stone fences, retaining walls, post-cairns, walls, and fences).

Mine: This includes excavations and associated structures and tailings built into the earth to extract natural resources.

Cemetery: As with Native American cemeteries, these are locations that appear to have been selected for human interment and include any single or multiple burial.

4.6.2 EFFECTS

This section summarizes the impacts to prehistoric, historic, ethnographic, and paleontological resources from implementing either the Proposed Program or any of the alternatives. Generally, in this section these resources will collectively be referred to as “cultural resources”, except where a distinction needs to be drawn for analysis purposes.

4.6.2.1 **Significance Criteria**

The management of archaeological and historical resources for the VTP is designed to comply with requirements of CEQA (as amended), the State CEQA Guidelines, the Public Resources Code (Section 5020 et. seq.), the California Register of Historic Resources (14 CCR § 4850 et seq.), and Executive Order W-26-92, and to conform to established CAL FIRE procedures (Foster and Pollack, 2010).

The CEQA Environmental Checklist specifies that the Program and Alternatives would have a significant adverse effect to prehistoric, historic, and paleontological resources if any of them would:

a) Cause a substantial adverse change in the significance of a historical resource, as defined in Section 15064.5 of the CEQA Guidelines (Bass et al., 1999)
b) Cause a substantial adverse change in the significance of an archaeological resource, pursuant to Section 15064.5 of the CEQA Guidelines
c) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature
d) Disturb any human remains, including those interred outside of formal cemeteries

In addition to prehistoric and historic archaeological sites, cultural resources also include those used for traditional cultural practices, or “ethnographic” resources. The term “traditional” refers to those beliefs, customs, and practices of a living community of people that have been passed down through generations, usually orally, or through practice. The term “cultural” refers to those attributes that are important to support the traditions, practices, lifeways, arts, crafts, or social institutions of a community, Indian Tribe, or other local ethnic group. The traditional cultural significance of a historic resource, then, is derived from the role the site plays in a community’s historically rooted beliefs, customs, and practices (USDI BLM, 2005). Examples of traditional sites possessing such significance include:

- Locations which are associated with the traditional beliefs of local Native American communities about their origin or cultural history, or the nature of the world
- Locations where Native American religious practitioners have historically gone, and are known or thought to go today, to perform ceremonial activities in accordance with traditional cultural rules of practice
- Locations where Native Americans have traditionally carried-out economic, artistic, or other cultural practices important in maintaining their historical identity (e.g., gathering sites for basketry materials or medicinal herbs)

4.6.2.2 **Determination Threshold**

The Program and Alternatives would have a significant effect to cultural resources if treatments ultimately result in:

a) A substantial adverse change in the characteristic(s) contained in that resource which qualify it as being significant
b) An adverse change to locations associated with the traditional beliefs of Native Americans, including areas used or assumed to be used for ceremonial activities
c) An adverse change to locations and or resources used by Native Americans to carry out or support economic, artistic, or other cultural practices

State law and regulation requires that any proponent of a VTP project must follow a defined methodology to determine the potential to affect cultural resources, including measures to avoid or mitigate adverse impacts to these resources (Foster and Pollack, 2010). This *Archaeological Review Process for CAL FIRE Projects* is described below and included in Appendix E.

The significance of a historical resource is materially impaired when a project demolishes or materially alters in an adverse manner the physical characteristics of a historical resource so that it would no longer be included in the California Register of Historic Places or a local register of historical resources (Bass et al., 1999).

An adverse change to an ethnographic resource is one that would lessen the ability of Native Americans to access traditional sites, or to utilize such sites or the resources therein for their traditional purposes.

A “substantial adverse change” in the significance of an historical resource means physical demolition, destruction, relocation, or alteration of the resource or its immediate surroundings such that the significance of an historical resource would be materially impaired.

4.6.2.3 **Data and Assumptions**

One of the primary goals of the Vegetation Treatment Program is to reduce the potential for high severity fires by restoring a range of native fire-adapted plant communities through periodic low intensity treatments within the appropriate vegetation types (Chapter 2.2, Objective 4). Before contact with Europeans, the indigenous Indian inhabitants of California conducted seasonal burning in order to manage for various amenities, including ease of travel, observation of the landscape, improvement of forage for game species, pest suppression (e.g., burning to reduce acorn worms), maintenance of grasslands for seed gathering, stimulating the production of basket materials, and others. These practices allowed for the development of healthy mixed-species and all-aged forests, with a high proportion of large conifers that could withstand repeated fire.

European intrusion greatly curtailed burning by Native Americans, but it continued on a limited scale. Seasonal burning was also commonly practiced by ranchers through the mid to late 1800s, but was suppressed by the USFS or other government entities during the widespread institution of fire suppression that began in the early 1900s. With the suppression of burning, the older trees became progressively older and more senescent, and timber stands became crowded with smaller trees and brush that had formerly been periodically removed by burning (Round Valley Indian Tribes, 2006).

Comparison of photographs (including aerial photographs) from the mid-1900s to the 1990s or later shows a decrease in grassland area as shrubs and trees encroached upon prairies. Today, due to the accumulation of fire-prone vegetation types and the seasonally fire prone Mediterranean climate of California, there is an elevated risk of high intensity wildfire across much of California. Fires that are more intense than those that occurred in the pre-contact landscape have the potential to degrade or destroy not only prehistoric cultural remains, but historical features and sites as well. While fire is often compatible with the lifeway values of current-day Indian people (such as production of basketry material), very intense fires can alter native plant communities and lead to infestation by non-native invasive plants. Restoration of natural fire regimes and removal of invasive vegetation can decrease the risk of high intensity wildfire while contributing to the restoration and maintenance of historic and ethnographic features (USDI National Park Service, 2003).

However, vegetation treatment techniques and methods pose their own risks to cultural resources. The use of heavy equipment or hand treatments to construct firelines and safety zones, or as the primary treatment for vegetation, did not occur in the pre-contact period and has greater potential to disturb cultural resources.

Because of the abundance of cultural resources within the state and the potentially destructive nature of many vegetation treatments, implementation of the Proposed

Program or any of the Alternatives has high potential to cause adverse impacts to cultural resources. This potential for harm, however, is balanced to a large extent by the protocol that CAL FIRE has instituted to avoid adverse impacts, as described below and included in Appendix E. When impacts to cultural resources are possible, the VTP contains an Archaeological Survey Report with a signature line whereby a professional archaeologist provides specific project approval.

LEGAL REQUIREMENTS

The *Archaeological Review Process for CAL FIRE Projects* (Foster and Pollack, 2010) summarizes the legal requirements for archaeological responsibilities of the agency, as below:

- ***"Legal Requirements:*** *A number of state laws and regulations require CAL FIRE to identify and protect cultural resources. Section 106 of the National Historic Preservation Act and its implementing regulations also apply to some CAL FIRE projects when federal funds are being used. The primary mandate requiring archaeological review of CAL FIRE projects is found in the California Environmental Quality Act (CEQA). This state law requires CAL FIRE to identify potential impacts to archaeological resources during our assessment of environmental impacts from CAL FIRE projects, and to change the project or develop mitigation measures to eliminate or reduce the severity of those impacts. Additional state agency requirements pertaining to the management of cultural resources on state-owned lands are found in Public Resources Code (PRC) Section 5024. Environmental Impact Reports (EIRs) for CAL FIRE's California Forest Improvement Program (CFIP), Vegetation Management Program (VMP), State Forest Management Plans, and our statewide Management Plan for Historic Buildings and Archaeological Sites contain specific requirements we must follow. California Executive Order W-26-92 directs CAL FIRE to develop programs for the preservation of the state's heritage resources throughout our jurisdiction. CAL FIRE also receives funding from several federal agencies to support our programs. This brings in a suite of federal laws and regulations pertaining to the protection of cultural resources. In 1996, CAL FIRE entered into a Programmatic Agreement (PA) with the U.S. Forest Service (USFS), State Office of Historic Preservation, and the Advisory Council on Historic Preservation that specifically addresses CAL FIRE's responsibilities for archaeological review of CAL FIRE projects funded by the USFS. This PA was superseded by a new PA in 2004 that is broader in scope to include CAL FIRE projects utilizing federal funds provided by the Bureau of Land Management (BLM) and United States Department of the Interior, Fish and Wildlife Service (FWS) in addition to the*

USFS. The procedures outlined in this document are intended to satisfy all of these legal requirements. A more complete listing of applicable laws and regulations is presented in CAL FIRE's Reference Manual and Study Guide for the CAL FIRE-CLFA Archaeological Training Program for Registered Professional Foresters and Other Resource Professionals."

STANDARD CAL FIRE PROTOCOL

CAL FIRE protocol for protecting cultural resources is based on the CAL FIRE Manual for the *Archaeological Review Procedures for CAL FIRE Projects* (Foster and Pollack, 2010). A description of this protocol follows. A complete copy is included in Appendix E, including a flow chart showing the review process for cultural resources for each CAL FIRE project as well as a detailed description of each of these steps.

For every project, a Preliminary Study to determine the potential for cultural resource impacts will be conducted by the project manager in collaboration with a CAL FIRE archaeologist or his/her designee. Based on recommendations from the Preliminary Study, further protective measures may be applied, including an on-the-ground cultural resources survey, notification of Native Americans, pre-field research, development of protective measures, recording of sites, and completion of an archaeological reconnaissance report. For projects funded with federal dollars, consultation with the State Historic Preservation Office (SHPO) under the requirements of Section 106 is required where significant archaeological or historic resources are identified.

If the Preliminary Study reveals the potential to affect cultural resources, the CAL FIRE project manager (or his/her designee) will conduct an intensive cultural resource survey of the project area. In most situations, this survey will include all of the procedural steps shown on the *Cultural Resource Review Procedures* flow chart included in Appendix E. Barring an unusual exception, the list of tasks specified in *Cultural Resource Survey Procedures* must be completed as part of the cultural resource review for every CAL FIRE project that is determined to have the potential to affect cultural resources. During the review of certain projects, the CAL FIRE project manager may determine that one or more of the procedural steps could be omitted. However, the concurrence of a CAL FIRE Archaeologist must be obtained in order to bypass any of these steps.

CAL FIRE has established a list of practices determined to have little potential to adversely affect cultural resources (Foster and Pollack, 2010). Barring unusual circumstances (such as consideration for Native American traditional gathering areas), if the proposed project includes only those activities, an archaeological (field) survey will not be required. If ground-disturbing activities are part of a proposed project, then an archaeological survey will be required. For projects that do not include ground-disturbing activities, this requirement can usually be waived. All forms of burning, including broadcast burning and the burning of piled brush, will usually require archaeological survey.

Although Program Environmental Impact Reports (Program EIRs) such as this one discuss the broad aspects of environmental impacts, specific project impacts are identified and mitigations are developed through the Environmental Checklist process, which includes a structured component for archaeological resources. That structure involves the actions of Unit Foresters, sometimes assisted by a consulting Registered Professional Forester (RPF) and/or VMP Coordinator, working in close consultation with a CAL FIRE Archaeologist, who completes, assists, or oversees the archaeological survey work and impact analysis. Almost all Unit Foresters, VMP Coordinators, and consulting RPFs have completed CAL FIRE's Certified Archaeological Training Course and provide valuable assistance to the CAL FIRE Archaeologist in completing this work. This process has been in place long enough that close working relationships have been developed, resulting in a well-coordinated and highly efficient archaeological review process that leads to the timely completion of archaeological clearance for the project and adequate protection for cultural resources (Foster and Robertson, 2005).

CAL FIRE's archaeological review procedures apply well to CAL FIRE projects where CAL FIRE is the lead agency and a certified Program EIR covers the results of the review. Once the VTP Program EIR is certified, projects must comply with the PSA, which will dictate procedures. Other agencies that rely on this document will need to ensure that their procedures meet or exceed the requirements this Program EIR requires, including a field archaeological survey, as needed.

If archaeological review procedures indicate that a project site has low potential for containing significant resources, the project may proceed without ongoing oversight by the CAL FIRE archaeologist. In such cases, if an unknown site is discovered during project operations, the project proponent is required by the VTP Contract to immediately halt all operations that could damage the site, and contact the local CAL FIRE Archaeologist for an evaluation of the significance of the site.

If potentially significant cultural resources are identified within the project boundaries, the project may proceed if the project manager and archaeologist incorporate site-specific protective measures. Such measures may include: 1) soil will not be disturbed in areas where disturbance would harm the resources; 2) specific sites will be left unburned if burning would tend to degrade the resources; 3) crews will be carefully supervised to avoid unauthorized collecting or other disturbance of the site; and/or 4) areas will be designated for avoidance by machinery, hand crews, and/or fire.

The effectiveness of the CAL FIRE procedure relies on the consultation and collaboration of the CAL FIRE project manager and the in-house expertise of the CAL FIRE Archaeologist. Project manager compliance is tracked through inclusion of questions specific to cultural resources in the PSA. CAL FIRE maintains a cadre of professional archaeologists who are assigned to review projects under CAL FIRE jurisdiction. There are 12 Cultural Resources Information Centers located around the state, which provide information on archeological and historical resources, allowing for ready identification of recorded cultural resources. Professional archaeologists on CAL FIRE staff have expertise regarding the multitude of factors that indicate the likely presence of an unknown site; this knowledge may also be supplemented by pre-project research. If a cultural site is potentially located within a proposed project area, a CAL FIRE certified surveyor will conduct an on-the-ground cultural resources survey. Based on the results of that survey, the project may be allowed to proceed without hindrance, or protective measures may be instituted to protect any potentially significant site, including cancellation or major redesign of the project.

4.6.2.4 **Bioregion Specific Effects**

BIOREGIONAL VARIATION IN CULTURAL RESOURCES OR EFFECTS FROM TREATMENTS

Certain regions within California contain notable concentrations of cultural resources, such as the historic resources associated with the Gold Rush in the Sierra Nevada foothills. Prehistoric resources, on the other hand, are common across the entire state, and are represented in each major vegetation type (timber, shrub, and grass). They tend to be associated with geographical features such as gentle terrain and water or lithic sources. Ethnographic, or traditional, resources are generally known to contemporary Native Americans; for instance, the California Indian Basketweavers Association (CIBA) actively manages many gathering areas on tribal and non-tribal lands, and the Hupa, Yurok, and Karuk people maintain and protect many village sites dating back thousands of years. Paleontological resources, though not as common as prehistoric resources, are found in many places statewide. For instance, Mount Diablo and Anza Borrego State Parks contain particularly rich and varied concentrations of fossils.

However, although certain areas are known or can be assumed to contain concentrations of cultural resources, the likelihood of the VTP program adversely affecting such resources cannot reasonably be differentiated by bioregion or major vegetation type. Prehistoric resources, in particular, are equally likely to occur in any bioregion or vegetation type due to the multi-millennia long occupation of the state by

Native Americans during the prehistoric period. Cultural resources of many types may occur within any bioregion and any number of vegetative types. While a proposed treatment in the Sierra foothills may be more likely to affect historic resources than in the Central Coast, there is nevertheless almost always potential for some type of cultural resource to occur within a proposed project area within any bioregion or environmental setting. For this reason, the analysis in this chapter will cover the entire state, and will focus on identification and protection measures to protect all significant sites, as prescribed by State law and regulation.

DIRECT EFFECTS COMMON TO ALL BIOREGIONS

Prehistoric, historic, and paleontological resources are fixed in place. Therefore, the effects on any of these resources located within the 60,000 acres annually treated by the proposed Program or Alternatives depend on whether the cultural resource sites are identified before significant degradation has occurred. Effects to both known and unknown sites are mitigated by the standard practices of applying the standard CAL FIRE protocol for VTP projects (see above and Appendix E). CAL FIRE has proposed Standard Project Requirements (SPRs) (see Section 2.6 for a complete list) applicable to all VTP projects and the additional ability to require Project Specific Requirements to address site specific concerns. Several SPRs specifically reduce the risk of impacts to archaeological and cultural resources from VTP projects. These include CUL-1 that requires a current records check to identify known sites in the project vicinity, and CUL-2 which requires notification of Native American groups of the project activities and location, and a request for information regarding cultural resources. CUL-3 identifies the criteria for conducting an archaeological survey, and CUL-4 and CUL-5 require consultation with a CAL FIRE archaeologist to develop protection measures or avoidance strategies for sites. Finally, ADM-1 and ADM-2 require any necessary protection measures to be flagged in the field and discussed with the contractor prior to the start of operations.

No threshold is proposed for the number of sites that could be degraded so as to diminish their significance as a result of the Program: any such degradation would be considered a potentially significant effect of the program and would require development and application of mitigation measures. Applying SPRs, the standard CAL FIRE protocol in Appendix E, and any PSRs will result in a **less than significant impact** to archaeological, cultural, and historic resources.

4.6.2.5 Effects by Program Activity

Program activities describe the treatment methods that will be used to modify vegetation within the project area to achieve the desired management objectives. These are fully described in Chapter 2.2. Vegetation activities may be applied singularly or in any combination needed for a particular vegetation type. The method, or methods, used will be those that are most likely to achieve the desired objectives while protecting natural resource values. Each activity and its potential impact on cultural resources is discussed individually below.

PRESCRIBED FIRE

Prescribed fire can produce a variety of changes to cultural resources that can be adverse, neutral, or beneficial depending on the intensity of the burn, types of materials comprising the resource, and history of previous fires. The relationship between these factors must be taken into consideration to adequately assess the effect of burning on specific characteristics of these resources and to identify appropriate mitigation measures.

Burn intensity is a product of combustion temperature, duration of heat, and heat penetration into the soil (Lentz et al., 1996). These, in turn, are dependent on environmental variables such as type and quantity of woody fuels, soil moisture content, wind, and air temperature. Studies typically describe these effects in terms of low, moderate, and high intensity burn categories that generally correspond to those defined by Eininger (1990):

- Low intensity burns—212-482°F, temperatures in soil do not exceed 212°F at a depth of 1-2 cm
- Moderate intensity burns—572-752°F, temperatures in soil will reach 392-572°F at a depth of 1 cm
- High intensity burns—932-1,382°F, temperatures in soil can reach 662-842°F at a depth of 1-2 cm and 212°F at 5 cm

The elevated temperatures for each of these categories are confined primarily to the ground surface, with little heat transferred below the first few centimeters of the soil. Preliminary studies show that when fuels are allowed to burn at a single location (e.g., such as a large log or stump) for an extended time, subsurface temperatures can become elevated substantially (Deal, 1997; Lentz et al., 1996).

Burn intensity can be correlated to some degree with typical fuels reported for specific vegetation types (Skinner and Chang, 1996). A summary of the relative effects of low, moderate, and high fire intensity to a variety of cultural resources, as well as dating techniques is in Table 4.6-1.

Table 4.6-1 Effects from Low, Moderate, and High Intensity Fire on cultural resources (Knight 1992)

Intensity	Associated Fuel Types	Cultural Materials Potentially Damaged	Surface vs. Subsurface Damage	Dendro-chronology	Thermo-luminescent dating of pottery and Archaeo-magnetic dating	Hydration Values
Low	Grassland, Forests with thin duff	Organic materials: Wood, Bone, Plant, Antler	Surface only	Negatively affected	None to light damage	Largely Unaffected
Moderate	Mixed Grass Prairie, Pinõn-Juniper,Younger Chaparral	Organic materials including pollen. Surface stone tools, glass bottles, marine shell, bone, pottery, lead, glass	Surface; subsurface with heavy fuels	Negatively affected	None to light damage	Moderate damage
High	Mature Chaparral, Ponderosa Pine, Pinõn Pine/Juniper	Same as moderate, also fossils, rock art, construction materials, ground stone items, sandstone masonry blocks.	Sub-surface likely damaged	Likely destroyed	Negatively affected	Not measurable, greatly damaged.

Because of the variability in burn conditions (e.g., fuel load, wind, humidity, and air temperature) it is difficult to make an absolute correlation of burn intensity with any particular vegetation type. This is especially true for areas in which fire suppression practices have allowed fuels to accumulate in higher concentrations than under pre-fire suppression conditions. SPR FBE-1 requires the burn prescription to limit fire intensity to that designed to only consume surface and ladder fuels. FBE-3 requires this to be verified through modelling to estimate consumption of fuels and tree mortality, among other parameters.

POST-BURN EFFECTS

The loss of ground cover after a prescribed burn can result in increased visibility of the ground surface, exposing site constituents to collection by the public and by uninformed fire crew personnel. The loss of water-holding capabilities of vegetation and litter create increased erosion hazard. These effects from surface erosion are more severe on slopes of higher gradient than those of lower gradient (Kight, 1992). Removal of vegetation by burning also removes vegetation that has aided in stabilizing masonry and dry-laid walls (Traylor, 1981). These effects are generally short term, and slow as vegetation cover is re-established (Kelley and Maburry, 1980; Kight, 1992).

If an area has been burned within the past 75 years or so, most of the perishable items may have been destroyed. However, archaeological and historical resources should be evaluated in relation to the following conditions:

- The potential for cumulative loss of information from repeated impacts
- The potential for future burn intensity to be more intense than past fire events (e.g., low versus high fuel buildup)
- The potential for recent surface exposure of artifacts or features from bioturbation and erosional processes

Beneficial effects as well can result from controlled burning practices. Reducing heavy fuel loads through controlled, prescribed burns will result in lower fire intensity in future natural or prescribed burns. Prescribed burning can be used to reestablish the historic environmental context of significant archaeological and historical resources. For example, fire can be used to combat the recent invasion of forest or chaparral vegetation into original grassland settings of a region, or remove overgrown brush from historic trails. For traditional Native American practices, burning can be used to promote the growth of certain plants used for spiritual practices (e.g., *Angelica* root) food, medicine, or craft manufacture. Post-fire surveys will reveal sites previously hidden by duff and slash, and better ground visibility will allow refinement of boundaries of previously identified resources, aiding in the future management of these resources.

MECHANICAL

Mechanical treatment poses the greatest risk to cultural resources of any VTP treatment method. Use of heavy equipment may adversely affect the physical integrity of cultural resources by physical destruction or damage, displacement, covering, uncovering and exposing resources to the elements, and/or to unauthorized collection. Impacts on resources could occur from disking, bulldozing, and driving across sites, or from covering sites with slash or chips from chipping operations. Clearing of vegetation reduces soil cover, exposing artifacts and facilitating surface erosion. Felling and removal of trees and other vegetation can also expose the ground surface and displace or expose cultural resources.

HAND TREATMENTS

Hand clearing can damage artifacts and their spatial distributions within resource areas in many of the same ways as mechanical clearing, though not typically to the degree caused by mechanical treatments. However, work crews and other project personnel may be tempted to collect artifacts.

HERBIVORY

The effects of herbivory on cultural resources can include trampling, artifact breakage, soil compaction (which can disturb soil profiles and affect dating), reduced ground cover, and destabilization of stream banks, leading to erosion and displacement of artifacts (USDA Forest Service, 2013). Grazing animals, especially large, heavy animals such as cattle, can dislodge and damage cultural resources (Osborn et al., 1987). Vegetation reduction by prescribed grazing may reduce flame lengths and thus fire severity. The clearing of vegetation may also expose cultural resources to the elements and to unauthorized collection. Fewer persons are involved with hand clearing than are on site during grazing activities, however, so the risk of collection is lower than for hand clearing. In Mexico, grazing on archaeological sites has led to erosion and unauthorized collection by herders (Garcia, trans. 2000). However, controlled grazing under the VTP would be much less likely to cause either of these effects. Herbivory using browsers, such as goats, could conceivably reduce vegetation (such as hazel shoots or bear grass) utilized by Indian basket weavers. Overall, negative effects of herbivory are considered lower than for mechanical or hand clearing.

HERBICIDES

Application of herbicides alone is unlikely to cause any direct effects to prehistoric, historic, or paleontological resources. However, herbicides could harm traditional use plants or threaten the health of the people gathering, handling, or ingesting recently treated plants, fish, or wildlife that are contaminated with herbicides. Since roots and other plant materials harvested by Native peoples may be found in close proximity to vegetation treatment areas, the potential exists for herbicides to drift from treatment areas onto gathering areas used by Native peoples. In some cases, vegetation important to Native peoples, including juniper, may be treated in areas where these plants are invasive and crowding out native vegetation (USDI BLM, 2005).

The use of herbicides on private and public lands is of utmost concern to California Indian basket weavers because of the potential harmful effects their use may have on the health of Native plant gatherers and communities, as well as the health and vitality of the environment. A weaver may be exposed to herbicides by making skin contact while gathering. In addition, most of the materials a weaver collects are passed through his or her mouth in preparing it for weaving. The plants that are eliminated by herbicide spraying because of their lack of commercial value are often the same plants that provide Native people with traditional foods and teas, and that are used in baskets, for healing, and for ceremonial and other traditional purposes (Kallenbach, 2008).

4.6.2.6 **Indirect Effects Common to All Bioregions of Implementing the Program**

OFF-SITE PROJECT IMPACTS

The Standard Project Requirements included in Section 4.6.3 below are focused on the project area; therefore, indirect effects of implementing the Program or the Alternatives could potentially occur if off-site operations of the project were to impact a cultural site outside of the project area. For instance, effects might occur if project equipment were parked on an adjacent area that had not been evaluated as part of the project, or if an access road ran through an unknown site. These impacts are considered transitory and unlikely; nevertheless, indirect impacts can be addressed by requiring the project proponent or state archaeologist to assess the potential for sites to exist on off-site areas that might be used for parking, crew campsites, transportation, etc.

EFFECTS FROM REDUCTION OF WILDFIRE INTENSITY

As discussed in more detail below, wildfire can have detrimental effects to cultural resources. Generally, the more intense the fire, the more potential there is to degrade cultural resources. The Proposed Program can therefore be expected to have a beneficial effect to cultural resources to the degree that wildfire intensity is decreased, thereby helping protect the integrity of the resources.

4.6.2.7 **Determination of Significance**

As long as the CAL FIRE archaeological protocol is followed throughout all the stages of each VTP project, including involvement of a professional archaeologist for evaluation and clearance of the project (CUL-4 and CUL-5), the VTP program will have a **less than significant impact** on prehistoric, historic, or paleontological state cultural resources. The safeguards that are in place must be supported by personnel and funding adequate to perform their stated intention, and include training of CAL FIRE personnel that design VTP projects, review and approval by the CAL FIRE archaeologist, including a determination that there will be no significant adverse effects by signing off on the Archaeological Survey Report for every project, and notification, review, and continued consultation and communication with Native American persons or groups who may have an interest in any project (CUL-2 and CUL-4). This protocol is codified in this Program EIR via inclusion in the Standard Project Requirements below and within Appendix E.

The No Project and Alternatives A-D treat the same acreage or less as the Proposed Program and therefor are also not likely to cause significant impacts to the archaeological, cultural, and historic resources. However, the goals of the Vegetation Treatment Program would not be met by utilizing these alternatives.

4.6.3 MITIGATION AND STANDARD PROJECT REQUIREMENTS

Each project will incorporate SPRs designed to protect and manage cultural resources, including prehistoric and historic archaeological resources and resources important to maintenance of American Indian traditional cultures. Procedures for protecting cultural resources will follow the most current edition of the CAL FIRE manual *Archaeological Review Procedures for CAL FIRE Projects* (January, 2003, updated November, 2006 and April, 2010). For every VTP project, a preliminary study to determine the potential for cultural resource impacts will be conducted by CAL FIRE/applicant in collaboration with a CAL FIRE archaeologist or his/her designee. Based on recommendations from the preliminary study, further protective measures may be applied, including an on-the-ground cultural resources survey, notification of Native Americans, prefield research, development of protective measures, recording of sites, and completion of an archaeological reconnaissance report. For projects funded with federal dollars, consultation with the State Historic Preservation Office (SHPO) under the requirements of Section 106 is required where significant archaeological or historic resources are identified.

4.6.3.1 Archaeological, Cultural, and Historic Resource-Related Standard Project Requirements

Under this analysis there are no mitigations. However, several Standard Project Requirements have been developed as part of the project design.

CUL-1: The project coordinator or designee shall order a current records check as per the most current edition of “Archaeological Review Procedures for CAL FIRE Projects” (CAL FIRE, 2010, see appendix H). The project coordinator may contact landowners within the project area who might have already conducted a records check for a Timber Harvest Plan or other project on their land to limit costly redundant records searches. Records checks must be less than five years old at the time of project submission.

CUL-2: Using the latest Native Americans Contact List from the CAL FIRE website, the project coordinator or designee shall send all Native American groups in the counties where the project is located a standard letter notifying them of the project. The letter shall contain the following:

- A written description of the project location and boundaries.
- Brief narrative of the project objectives.
- A description of the types of activities used in the project (e.g., prescribed burning, mastication) and associated acreages.

- A project and general location map. Project map shall be of sufficient scale to indicate the spatial extent of activities within the project area.
- A request for information regarding potential cultural impacts from the proposed project.

CUL-3: The project coordinator or designee shall contact a CAL FIRE archaeologist or CAL FIRE Certified Archaeological Surveyor to arrange for a survey of the project area if necessary. The specific requirements need to comply with the most current edition of “Archaeological Review Procedures for CAL FIRE Projects” (CAL FIRE, 2010).

CUL-4: Protection measures for archaeological and cultural resources shall be developed through consultation with a CAL FIRE archeologist. If new archaeological sites are discovered, the project coordinator or designee shall notify Native American groups of the resource and the protection measure with the standard second letter (see appendix H). Locations of archaeological resources should not be disclosed on a map to the members of the public including Native American groups.

CUL-5: If an unknown site is discovered during project operations, operations within 100 feet of the identified boundaries of the new site shall immediately halt, and the project will avoid any more disturbances. A CAL FIRE Archaeologist shall be contacted for an evaluation of the significance of the site. In accordance with the California Health and Safety Code, if human remains are discovered during ground disturbing activities, CAL FIRE and/or the project contractor(s) shall immediately halt potentially damaging activities in the area of the burial and notify the County Coroner and a qualified professional archaeologist to determine the nature and significance of the remains.

ADM-1: Prior to the start of operations, the project coordinator shall meet with the contractor to discuss all resources that must be protected using standard project requirements (SPRs). If burning operations are done with CAL FIRE personnel, the Battalion Chief and/or their Company Officer designee shall meet with the project coordinator onsite prior to operations to discuss resource protection measures. Additionally, the project coordinator shall specify the resource protection measures and details of the burn plan in the incident action plan (IAP) and shall attend the pre-operation briefing to provide further information.

ADM-2: Prior to the start of operations, and at the discretion of the project coordinator, a registered professional forester (RPF) shall flag and/or fence all protected resources for avoidance during operations. The RPF shall also be required to engage other resource professionals that may address issues beyond the RPF’s experience or expertise, as required by the Professional Foresters Licensing Law (Public Resources Code Sections 752(b)). The project coordinator or designee shall remove the fencing from around the protected resource after project completion.

PSA Item 4.6-1 Would archaeological, cultural, or historical resources be adversely affected by this project? *[Include Archaeological reviews and/or surveys in confidential addendum]*

PSA Item 4.6-2 Will the project directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?

PSA 4.6-3 Will the project disturb any human remains, including those interred outside of formal cemeteries?

4.7 NOISE

The projects implemented under this proposed Program and Alternatives have the potential to create noise impacts. The evaluation of noise impacts has been broken up into three sections:

- **4.7.1 – Affected Environment**
    - The Affected Environment section discusses the regulatory framework that establishes limits on noise generation as well as sensitive receptors to noise in California.
- **4.7.2 – Effects**
    - The Effects section outlines the potential impacts of implementing the proposed Program and the Alternatives.
- **4.7.3 – Mitigations**
    - The Mitigation section provides the standard program requirements and project specific requirements that will reduce the likelihood of the proposed Program causing significant adverse impacts to noise.

4.7.1 AFFECTED ENVIRONMENT

The purpose of the Noise section is to identify, describe, and evaluate noise sources and potential land use conflicts related to environmental noise. In addition, this section summarizes the impacts due to noise from implementing either the Proposed Program or any of the Alternatives.

The Vegetation Treatment Program (VTP) is a statewide program and while typically would be operating in rural forested and range settings, it also likely to operate in the WUI where communities are developing in areas with high fuel loads. These are predominately rural areas that can be characterized as generally quiet, but can frequently experience increased noise levels for a short duration that are associated with timber/forestry operations, ranching and related farm equipment, recreation activities, motor vehicles, and wildlife. Ambient (background) sources of natural noise range from short-term soft sounds, as in the sound of rustling trees (20-30 decibels), to short-term loud cracks and rumbles, as in the sound of air conditioning units or vacuum cleaners (60-80 decibels). Ambient noise can also be loud and constant, such as when using an outboard motor (100 decibels). Community noise or "ambient" noise includes background noise from traffic, machines, and people. Ambient forest and range noise comes from both natural and man-caused sources. Noise associated with VTP activities vary with treatment type. Some noise is short-term; some is constant, but any potential impacts should be of a limited duration. The following is a description of the various sources of man-made ambient noise that could be associated with the VTP program:

- Vehicle traffic (adjacent highways and access roads)
- Aircraft noise
- Equipment usage for VTP activities (machines, chain saws, chippers, etc)
- Livestock, if herbivory is used
- Conversational noise

Vehicle Traffic–Traffic noise is a function of the receptor's distance from roads, which cannot be adequately assessed at the programmatic level. Rather, it requires consideration during project level review.

Equipment Usage–Construction noise is similar to that of VTP equipment usages; essentially it is the sound of machinery at work. Machinery may include chainsaws, chippers, back-up beepers, yarding tooters, diesel motors, cable yarders, helicopters, and other power tools and engines.

4.7.2 EFFECTS

4.7.2.1 Significance Criteria

As previously stated, the California Code of Regulations (CCR), section 65302(f) requires that Counties contain a noise element in their General Plans. In addition, California Department of Health Services (1987) has developed noise guidelines for noise elements in local General Plans. The State guidelines also recommend that local jurisdictions consider adopting local nuisance noise control ordinances. Because CAL FIRE is the proponent and lead agency for this Program EIR, compliance with local standards is not required. However, the State considers local noise standards as they relate to the compatibility between the Program and various land uses adjacent to project sites. Thus, local noise standards are used as guidelines for what the CAL FIRE considers as acceptable noise levels in noise-sensitive areas.

Noise impacts would be considered significant if the Program and the Alternatives would cause:

a) Exposure of persons to or the generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies;

b) Exposure of persons to, or the generation of, excessive ground-borne vibration or ground-borne noise levels;
c) Substantial permanent increase in ambient noise levels in the project vicinity (above levels existing without the project);
d) Substantial temporary increase in ambient noise levels in the project vicinity (above levels existing without the project).

4.7.2.2 **Determination Threshold**

The proposed Program and Alternatives are considered to create a significant effect when a treatment or treatments creates:

a) Noise in excess of 90 dBA at 50’, or in excess of 65 dBA at 1,600’ at sensitive receptor locations (schools, residential units, churches, libraries, commercial lodging facilities, and hospitals or care facilities).
b) Noise levels in excess of 70 dBA L_{dn}
c) The Program and Alternatives are considered to create moderately adverse effects when noise levels are between 60 and 70 dBA L_{dn} (State Office of Noise Control, 1976).

4.7.2.3 **Impacts From Implementing the Program/Alternatives**

IMPACT A - EFFECTS TO HUMAN HEALTH AND COMMUNITY WELL-BEING

Noise is often defined as unwanted sound, and thus is a subjective reaction to characteristics of a physical phenomenon. In addition, noise impacts apply only if the noise is heard or felt. The vegetated nature and often high relief of the treatment areas can create an environment in which topographical features and vegetation dampen much of the noise. However, VTP treatments, particularly helicopter-assisted prescribed fire, most mechanical treatments, and hand treatments using chainsaws can present a source of significant temporary noise.

The human response to environmental noise is subjective and varies considerably from individual to individual. Noise in the community has often been cited as a health problem, not in terms of actual physiological damage, such as hearing impairment (though hearing loss can occur at high noise intensity levels), but in terms of inhibiting general wellbeing and contributing to undue stress and annoyance. The health effects of noise arise from interference with human activities, including sleep, speech, recreation, and tasks demanding concentration or coordination. When noise interferes with human activities or contributes to stress, public annoyance with the noise source increases.

The vast majority of the noise generated from proposed Program treatments will be located in relatively unpopulated parts of the state where sensitive receptors such as hospitals, schools, libraries, churches, etc., are often miles from the treatment site. The exception is likely to be WUI treatments, where operations might take place immediately adjacent to residential homes. Typically, operations immediately adjacent to structures would utilize hand equipment (e.g. chainsaws).

Noise can have a negative effect on people's recreational experience if operations are conducted on or near public lands such as near campgrounds and trails (e.g. State Parks). The vast majority of the treatable acreage is composed of private land where private landowners themselves propose the treatments.

Disturbances associated with mechanical treatments would be substantial, though short in duration. Equipment associated with mechanical treatments can generate noise levels ranging from approximately 75 to 90 dBA at 50 feet, depending upon the equipment being used, although mobile chippers can reach sound levels of 115 dBA. Typical operating cycles may involve two minutes of full-power operation, followed by three or four minutes of operation at lower levels. In addition, treatment activities are carried out in stages, during which the character and magnitude of noise levels surrounding the treatment area changes as work progresses, as different equipment is used and the location of the noise-generating work moves throughout the treatment area.

Properly maintained equipment produces noise levels near the middle of the indicated ranges. Activities such as tractor piling, masticating, chipping, falling of small trees/shrubs with chainsaws, etc., are the most common noise generators. As a result, proposed Program equipment and tools typically will generate noise levels of 70–90 dBA at a distance of 50 feet.

The sounds from heavy equipment are often dampened or attenuated by the surrounding vegetation and soft ground surface. This type of attenuation would not occur with helicopter treatments, since air does not attenuate sounds the same way the ground surface does. As a result, helicopter sounds can carry unobstructed for many miles because they often fly above the natural sound barriers.

Chapter 4.10 describes the likely number of vehicles used daily to carry workers to and from the treatment site that would also contribute to noise. Generally, the noise from vehicles carrying workers to treatment sites is likely to be less than the noise created by the treatments themselves.

The potential effects due to implementing the Program or Alternatives will be of short duration (less than 10 weeks per project on average) and limited to typical workday hours (approximately 7AM to 7PM).

It is unlikely that a single residential or commercial area will be affected by the noise from more than one project annually. Even for an area where multiple treatments occur within one year, the odds of all treatments occurring simultaneously are low. Therefore, at most and only in rare cases would the nearest residential or commercial area to a VTP-treated area be affected by two simultaneous projects.

Table 4.7-1 Number of projects by activity for the proposed program

	RX Burn Helicopter	Mechanical	Manual	Herbicides	Herbivory
dBA Maximum Likely	90	90	90	70	65
Weeks/260 acre treatment	0	5-10	5-10	5-10	5
Bioregion	**Number of Projects Per Year**				
Bay Area/Delta	11	4	2	2	2
Central Coast	15	6	3	3	3
Colorado Desert	2	1	0	0	0
Klamath/North Coast	28	11	6	6	6
Modoc	13	5	3	3	3
Mojave	5	2	1	1	1
Sacramento Valley	4	2	1	1	1
San Joaquin Valley	3	1	1	1	1
Sierra Nevada	23	9	5	5	5
South Coast	10	4	2	2	2
Total	**115**	**46**	**23**	**23**	**23**

See Appendix F for more information regarding equipment dBA.

The amount of noise associated with prescribed fire treatments above in Table 4.7-2 is based on all treatments being implemented via helicopter. In reality, many (50 percent or more) treatments would be implemented using hand ignition so that noise associated with prescribed fire will often be far less than estimated above.

Most treatments take place in rural areas. For example, within approximately 230 projects that might be implemented per year, 135 (57 percent) of the projects will take place in rural bioregions such as the North Coast/Klamath, Modoc, Sacramento Valley, San Joaquin, Mojave, and Colorado Desert.

Assuming that half of all prescribed fire treatments are conducted using hand ignition, about 105 of the 230 projects conducted yearly would be conducted at noise levels of around 65-70 dBA, while the balance of the projects would have periods during the day when sound levels could reach 90 dBA within 50 feet of the treatment equipment. About 126 projects would be implemented across approximately 38 million acres of jurisdiction lands where sound levels could reach 90 dBA at particular times between 7AM and 7PM, five days per week for periods as long as ten weeks. However, as noted above, peak noise levels are rarely continuous over periods of more than two minutes at a time due to equipment maneuvering, chainsaw operators moving to the next piece, etc.

Implementation of the proposed VTP includes six Standard Project Requirements that reduce noise impacts to a less than significant level. NSE-1 ensures that local noise restrictions are not violated, particularly time-of-day restrictions, and establishes a project-level standard restriction if local ordinance does not have one. NSE-1 ensures that there are no impacts to noise receptors during sensitive times of day (notably, during normal sleeping hours). Noise SPRs NSE 2, 3, and 5 implement standard industry practices that reduce noise from powered or motorized equipment. NSE-4 ensures noise-generating equipment is located as far as possible from nearby noise-sensitive land uses and NSE-6 requires notification of those sensitive receptors of a project in the area. NSE-4 and 6 ensure that sensitive receptors are aware of any projects nearby and not affected by noise impacts.

Operation of heavy equipment can generate ground-based vibration, particularly operations by dozers. Rubber tired skidders, masticators, mowers, roller choppers, etc., usually do not develop the amount of ground based vibration that a 45,000 pound or larger (D7 or equivalent) dozer can. However, while dozer operations might take place within several hundred feet of sensitive receptor locations, vibrations from such operations are expected to be short duration, consistent with the operational performance times noted above. In addition, only about 20 percent of annual treatments within any bioregion would be mechanical, and then, not all of those would use a dozer. Implementation of the Program will not generate or expose persons to excessive ground-borne vibration because the extent and intensity of such treatments is of short duration. As a result, the Proposed Program would not create a substantial adverse effect and the impacts are expected to be **less than significant**.

Implementation of the Program could generate or expose persons at sensitive receptor sites to noise levels of 90 dBA at 50 feet or in excess of 65 dBA at 1,600 feet, or 70 dBA L_{dn}, and therefore potentially create a significant effect. However with adoption of the SPRs below, the effect is **less than significant**.

It is not possible to make a determination as to whether implementation of the proposed Program would be in excess of standards established in the revised noise elements of County General Plans or applicable standards of other agencies because the specific location of Proposed Program treatments is not known. However, with adoption of SPRs in 4.7.3 and any PSRs developed as a result of a Project Scale Analysis, the potentially substantial adverse effects are expected to be **less than significant**.

Because of the transitory nature of VTP projects, implementation of the Program will not result in a permanent increase in ambient noise levels above levels existing without the project, and therefore would not create a substantial adverse effect resulting in a **less than significant impact** to the environment.

The No Project alternative would apply to a landscape that is larger than the proposed Program, but due to costs, time constraints, and other limitations, it is anticipated that a smaller amount of acreage would actually be treated each year. Because of this, it is not likely to cause significant impacts to human health and community well-being due to noise.

Alternative A would treat a smaller landscape as the Proposed Program, but treat the same number of acres. Because projects would only be allowed in the WUI, Alternative A is more likely to result in simultaneous projects occurring in or near a particular community, and therefore more likely to cause significant noise impacts to human health and community well-being.

Similarly, Alternative B would treat a smaller landscape but the same number of acres as the Proposed Program, but only allow WUI and fuel break projects. Due to the limited types of projects that could be implemented, it is more likely that, under Alternative B, a community would have more than one simultaneous fuel reduction project occur, and therefor noise impacts to human health and community well-being would be significant.

Alternative C would also treat a smaller landscape but the same number of acres as the Proposed Program. This Alternative would limit projects to VHFHSZ, which are determined by the existing fuels, topography, weather/climate, crown fire potential, and ember production and movement. Because this Alternative would exclusively focus projects in areas of high hazard and not human development (as in Alternatives A and B), with the SPRs proposed below Alternative C would not result in significant noise impacts to human health and community well-being.

Alternative D would treat the same landscape as the Proposed Program but treat a smaller amount of acres due to the reduction of the use of prescribed fire. Although the maximum likely dBA of prescribed fire projects is the highest of all treatment methods, prescribed fire using helicopter has the shortest duration of all treatment methods. Since noise affects individuals differently, different people will be bothered by loud noise over a short period or moderate noise over a longer period. However, the reduction in prescribed fire is not replaced entirely by increases in other treatment methods, and so the overall noise impacts are less. Because of the overall smaller treatment area proposed, and with the SPRs proposed below, Alternative D would not result in significant noise impacts to human health and community well-being.

IMPACT B - EFFECTS ON SENSITIVE RECEPTORS

Treatments near sensitive receptors are more likely to occur in the Sierra Nevada, Bay Area, Central Coast and South Coast bioregions than the other bioregions. Otherwise, noise effects in these bioregions are expected to be similar to the other bioregions. Although prescribed fire using helicopters is applied more often in these bioregions, especially in the Sierra Nevada and Central Coast, there is a potential that somewhat less noise might be generated compared to the other bioregions. Helicopters generate more noise during operation than hand ignition but the duration of these projects (and thus total noise effects) is shorter. It is common for an entire 260 acre project to be burned in one day using a helicopter compared to several days or more utilizing hand ignition.

There are potential indirect effects to human health and to wildlife associated with noise from the Proposed Program. Indirect effects to human health and to the health of wildlife arise in terms of inhibiting general wellbeing and contributing to undue stress and annoyance. However, projects are of a temporary nature, and should not result in any long-term noise-related indirect effects specific to any bioregion.

Most of the Proposed Program treatments are far removed from sensitive receptor sites such as schools, churches, hospitals, and libraries. Noise associated with the Proposed Program will temporarily increase noise levels from project activities including production of noise levels of 90 dBA at 50 feet or in excess of 65 dBA at 1,600 feet, or 70 dBA L_{dn}, and thus these effects could create substantial adverse effects. The severity of such impacts will be temporary and the effects are dependent on the number of individual projects that might occur simultaneously. Adoption of the SPRs below will reduce these potentially substantial adverse effects to **less than significant**.

The No Project alternative would apply to a landscape that is larger than the proposed Program, but due to costs, time constraints, and other limitations, it is anticipated that a smaller amount of acreage would actually be treated each year. Because of this, it is not likely to cause significant impacts to sensitive receptors due to noise.

Alternative A would treat a smaller landscape as the Proposed Program, but treat the same number of acres. Because projects would only be allowed in the WUI, Alternative A is more likely to result in simultaneous projects occurring in or near a particular community, and therefor likely to cause significant noise impacts to sensitive receptors.

Similarly, Alternative B would treat a smaller landscape but the same number of acres as the Proposed Program, but only allow WUI and fuel break projects. Due to the limited types of projects that could be implemented, it is more likely that, under Alternative B, a community would have more than one simultaneous fuel reduction project occur, and therefor noise impacts to sensitive receptors would be significant.

Alternative C would also treat a smaller landscape but the same number of acres as the Proposed Program. This Alternative would limit projects to VHFHSZ, which are determined by the existing fuels, topography, weather/climate, crown fire potential, and ember production and movement. Because this Alternative would exclusively focus projects in areas of high hazard and not human development (as in Alternatives A and B), with the SPRs proposed below Alternative C would not result in significant noise impacts to sensitive receptors.

Alternative D would treat the same landscape as the Proposed Program but treat a smaller amount of acres due to the reduction of the use of prescribed fire. Although the maximum likely dBA of prescribed fire projects is the highest of all treatment methods, prescribed fire using helicopter has the shortest duration of all treatment methods. Since noise affects individuals differently, different people will be bothered by loud noise over a short period or moderate noise over a longer period. However, the reduction in prescribed fire is not replaced entirely by increases in other treatment methods, and so the overall noise impacts are less. Because of the overall smaller treatment area proposed, and with the SPRs proposed below, Alternative D would not result in significant noise impacts to sensitive receptors.

4.7.2.4 **Similar Effects Described Elsewhere**

The effects of noise to wildlife are described in chapter 4.2.

4.7.3 MITIGATION AND STANDARD PROJECT REQUIREMENTS

Under this analysis there are no mitigations. However, several Standard Project Requirements have been developed as part of the project design.

NSE-1: Noise generating activities shall abide by the time-of-day restrictions established by local jurisdictions (i.e., city and/or county) if such noise would be audible to receptors located in applicable local jurisdictions. Cities and counties in California typically restrict noise to particular daytime hours. If the local applicable jurisdiction does not have a noise ordinance or policy restricting the time-of-day when noise-generating activities can occur, then noise-generating activities shall be limited to the hours of 0700 to 1900 Monday through Friday.

NSE-2: All powered equipment shall be used and maintained according to manufacturer's specifications.

NSE-3: Equipment engine shrouds shall be closed during equipment operation.

NSE-4: All heavy equipment and equipment staging areas shall be located as far as possible from nearby noise-sensitive land use (e.g., residential land uses, schools, hospitals, places of worship).

NSE-5: All motorized equipment shall be shut down when not in use. Idling of equipment or trucks shall be limited to 5 minutes.

NSE-6: Public notice of the proposed project shall be given to notify noise-sensitive receptors of potential noise-generating activities.

4.8 RECREATION

Recreation has been broken up into three sections:

- **4.8.1 – Affected Environment**
  - The Affected Environment section discusses the ownership patterns of recreational land in the state and the geographic extent of recreational land in each bioregion.
- **4.8.2 – Effects**
  - The Effects section outlines the potential impacts of implementing the proposed Program and the Alternatives.
- **4.8.3 – Mitigations**
  - The Mitigation section provides the standard program requirements and project specific requirements that will reduce the likelihood of the proposed Program causing significant adverse impacts to recreational resources.

4.8.1 AFFECTED ENVIRONMENT

This section discusses recreational resources that could be affected by the proposed program. The recreation analysis focuses on recreational opportunities within state parks, public and private trails, and other recreational facilities. The VTP program has the potential to operate on state parks and has the potential to affect recreational use. In addition, this section summarizes the impacts to recreation due to implementing either the Proposed Program or any of the Alternatives.

Outdoor recreation is an important attribute for all public forests and rangelands as well as some private forest and rangelands in California. In addition to the scenic value of these lands, various types of outdoor recreation on forests and rangelands are a significant component of the quality of life for many Californians and a major attraction for many out-of-state visitors. With over half of all land in California in public ownership and available for recreation, Californians have a wide array of opportunities.

The major suppliers of outdoor recreation on forests and rangelands in California include the U.S. Forest Service (USFS), the National Park Service (NPS), U.S. Bureau of Land Management (BLM), California State Park System, and local governments. Other minor public providers include the U.S. Bureau of Reclamation (BOR), U.S. Army Corps of Engineers (USACE), public utility companies, and various departments of the California Natural Resources Agency. Local, county, and regional providers are another source for wildland outdoor recreation but the boundaries between wildland recreation and urbanized recreation become hard to define. With urban areas containing over 81 percent of the California's population, these local areas are a dominant provider of recreation, especially open space aesthetics. Table 4.8-1 provides a summary of area available for wildland recreation by bioregion.

Table 4.8-1 Public land available for wildland recreation (CPAD, 2014)

Bioregion	Tree	Grass	Shrub	Water	Wetlands	Total
Bay Area/Delta	273,079	395,041	243,227	61,279	33,568	1,006,195
Central Coast	391,686	840,708	1,303,386	28,437	2,217	2,566,434
Colorado Desert	81,394	4,495	3,894,457	207,756	45	4,188,148
Klamath/North Coast	5,563,668	1,680,960	1,712,521	80,623	14,571	9,052,344
Modoc	2,126,118	117,514	2,175,547	103,843	43,447	4,566,469
Mojave	454,378	71,459	12,963,648	8,508	7,835	13,505,827
Sacramento Valley	15,846	7,724	14,723	19,703	28,879	86,876
San Joaquin Valley	80,699	478,055	92,817	15,158	19,568	686,297
Sierra Nevada	6,965,247	2,977,048	16,482	227,936	81,120	10,267,832
South Coast	555,829	157,248	1,710,573	37,334	6,594	2,467,579
By Habitat Type	**16,507,943**	**6,730,253**	**24,127,381**	**790,577**	**237,845**	**48,393,999**

4.8.1.1 Setting

The treatable acreage includes land open to public recreation that are owned by state agencies including CAL FIRE, Parks, Fish and Wildlife, Conservancies, Water Resources, and others. These approximately 1.9 million acres of land constitute the vast majority of lands whose recreational opportunities could be affected by VTP projects. Assuming that these lands have an equal probability of receiving VTP projects as other lands within CAL FIRE jurisdiction allows extrapolation of Table 2.5-6 to estimate the percentage of state-owned recreational lands that are likely to be affected by VTP treatments annually under the Proposed Program (Table 4.8-2).

Table 4.8-2 Treatable Acres Under State Ownership in acres (FRAP, 2013).

Bioregion	Tree	Grass	Shrub	Total
Bay Area/Delta	119,637	67,727	131,211	318,575
Central Coast	124,136	48,417	13,365	185,919
Colorado Desert	644	323,576	48,654	372,873
Klamath/North Coast	16,576	25,956	283,328	325,860
Modoc	41,321	55,682	21,323	118,326
Mojave	1,958	30,632	14,764	47,353
Sacramento Valley	55,459	1,298	3,040	59,797
San Joaquin Valley	120,565	8,348	10,716	139,628
Sierra Nevada	50,108	41,888	84,353	176,349
South Coast	31,697	124,118	31,747	187,563
By Treatable Acres	**562,101**	**727,642**	**642,501**	**1,932,244**

Recreational areas near metropolitan areas receive more use than remote recreational areas. It is assumed that likelihood of VTP treatments occurring is equal between high and low use recreation areas, but VTP treatments in high use areas would be likely to directly and indirectly affect more people than treatments in remote areas.

4.8.2 EFFECTS

4.8.2.1 Significance Criteria

Appendix G of the CEQA Guidelines, the CEQA Environmental Checklist, poses the following to be considered in determining whether the Program or Alternatives would cause significant impacts to recreation. The Program and Alternatives would create significant effects if they would:

- Increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?
- Include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment?

4.8.2.2 Determination Threshold

Because the proposed Program does not impact the use of parks or recreational facilities, or require the construction or expansive of recreational facilities, alternative determination thresholds have been developed to analyze the impacts of the proposed Program and Alternatives. An effect is considered significant if it would:

a) Close a significant portion of public recreational areas because of VTP treatments during the peak visitor season over a calendar year.

b) Severely reduce visual quality (more than 80 percent burned and black, cleared of vegetation, or comprised of dead plants) on more than 10 percent of the area of any one state park, private recreation area or other publicly accessible recreational area, during the peak visitor season over a calendar year.

IMPACT A – RECREATIONAL AREA CLOSURES

It is likely that lands subject to VTP treatments would be closed to recreational use for the duration of the project, which is not likely to exceed two weeks. The area affected for recreational use may exceed the boundaries of the project area for prescribed burning projects due to smoke generation. For non-burning treatments, the area affected for recreational use is not likely to exceed the project boundaries. Except in the Colorado Desert, treatable recreation areas are 10 percent or less of the total treatable acreage in each bioregion (Appendix G). Additionally, not all projects under this Program EIR in each bioregion will take place on state owned recreational lands, nor would they take place within the same calendar year.

In the Colorado Desert Bioregion, 74 percent of the treatable acreage under this program is recreational lands. However, it is estimated that only 3 percent of the program’s treatments will take place in this bioregion. It is unlikely that all the recreational treatable acres will be treated, and it is not likely that projects would occur simultaneously or entirely during peak visitor season. Thus, it is very unlikely that VTP projects would close a significant amount of recreational areas in the Colorado Desert or any other bioregion simultaneously due to VTP projects.

Implementation of VTP projects is likely to be spread over the entire year, with many projects occurring in non-peak visitation months. Peak visitor use tends to occur during the summer months for many recreational areas. Prescribed fire, which is the most common treatment type, is most commonly implemented in fall, winter and spring, which are off-peak months for recreational use.

The below PSA items will be included to address project-specific recreational impacts that are not detected at the scale of the bioregion. With the application of the SPRs in Chapter 2.5 and any PSRs identified through the analysis questions, effects to recreational access due to implementing the Proposed Program are likely to be small scale, short term, and **less than significant.**

IMPACT B – RECREATIONAL VIEWSHED

A potential effect to recreational use includes decreased visual quality for users due to presence of recently treated VTP projects in their viewshed. For tree vegetation types it is unlikely that any VTP treatment would result in a viewshed where more than 80 percent of the area was burned and black, cleared of vegetation, or comprised of dead plants. For grass and shrub vegetation types it is possible that VTP treatments could result in more than 80 percent of the project area burned and black, cleared of vegetation, or comprised of dead plants. However, most of the treatments will take place in the spring, fall, or winter, which are non-peak visitor months. Clearing understory vegetation is likely to improve the recreational resource in many cases due to increased visibility and access.

Only the Bay Area/Delta, Colorado Desert, and South Coast Bioregions are dominated by grass and shrub vegetation types within which more than 5 percent of the bioregion’s treatable acreage is recreational acreage. Thus, recreation is more likely to be indirectly affected in these three bioregions due to decreased visual quality, compared to the other bioregions. However, there is low likelihood that more than 10 percent of a given recreational area (state park, conservancy, etc.) would be treated in a single year, unless the recreational area was very small.

Additionally, in the Bay Area/Delta, Colorado Desert, and South Coast Bioregions, it is anticipated that only 7, 3, and 6 percent of the proposed program acreage would be treated in those bioregions, so it is unlikely that 10 percent or more of a recreational area in that bioregion would be treated at once.

The below PSA will be included to address project-specific recreational impacts that cannot be detected at the scale of the bioregion. With the application of the SPRs in Chapter 2.5 and any PSRs identified through the PSA questions, effects to recreational viewsheds due to implementing the Proposed Program are likely to be small scale, short term, and **less than significant.**

The No Project Alternative and Alternatives A-D treat the same acreage or less as the Proposed Program and therefor are also not likely to cause significant adverse effects to the recreational resource. However, the goals of the Vegetation Treatment Program would not be met by utilizing these alternatives.

IMPACTS DUE TO IMPLEMENTING ANY OF THE ALTERNATIVES

The No Project alternative would apply to a landscape that is larger than the proposed

Program, but due to costs, time constraints, and other limitations, it is anticipated that a smaller amount of acreage would actually be treated each year. Because of this, it is not likely to cause significant impacts to recreational closures or viewsheds.

Alternative A would treat a smaller landscape as the Proposed Program, but treat the same number of acres. Because projects would only be allowed in the WUI, Alternative A would drastically reduce the number of projects on recreational land, since any treated recreational land would have to exist in the WUI area. This Alternative would result in less than significant impacts to recreational closures or viewsheds.

Similarly, Alternative B would treat a smaller landscape but the same number of acres as the Proposed Program, but only allow WUI and fuel break projects. Alternative C would also treat a smaller landscape but the same number of acres as the Proposed Program, but would limit projects to VHFHSZ, which are determined by the existing fuels, topography, weather/climate, crown fire potential, and ember production and movement. Because these Alternatives continue to focus the VTP on areas that do not necessarily overlap with recreational areas (human development and very fire hazard, respectively), there is an overall less than significant impact to recreational closures or viewsheds due to Alternatives B and C.

Alternative D would treat the same landscape as the Proposed Program but treat a smaller amount of acres due to the reduction of the use of prescribed fire. Because of the overall smaller treatment area proposed and the reduction in the use of prescribed fire, Alternative D would not result in significant impacts to recreational area closures or viewsheds.

4.8.2.3 Similar Effects Described Elsewhere

Impacts to visual and aesthetic resources are described in Section 4.13.

4.8.3 MITIGATION AND STANDARD PROJECT REQUIREMENTS

No mitigation measures or standard project requirements are required. However, the following checklist items will be included in the environmental checklist.

PSA Item 4.8-1 Will the proposed project result in a significant portion of the recreational area being closed to recreational use during peak visitor season over a calendar year, or more than 10 percent of the recreational area in a condition of decreased visual quality during peak visitor season?

4.9 UTILITIES AND ENERGY

Utilities and Energy has been broken up into three sections:

- **4.9.1 – Affected Environment**
    - The Affected Environment section discusses the origins and use of power in California and the regulations that govern utilities and energy in the state.
- **4.9.2 – Effects**
    - The Effects section outlines the potential impacts of implementing the proposed Program and the Alternatives.
- **4.9.3 – Mitigations**
    - The Mitigation section provides the standard program requirements and project specific requirements that will reduce the likelihood of the proposed Program causing significant adverse impacts to utilities and energy.

4.9.1 AFFECTED ENVIRONMENT

This section describes the environmental setting for Utilities and Energy. The Utilities section of the Program EIR explains the distribution of the utilities used within California and those potentially affected by the VTP program. These include electricity, water, and renewable energy sources that include biomass, hydro, wind, and geothermal. Figure 4.9-1 below shows the location of power plants by type in California.

Utilities (transmission lines, substations, etc.) and water supply facilities are at risk from wildfires. Wildfires have the potential to damage or destroy transmission lines. Depending on the extent of the damage the impact to transmission lines from a wildfire could have a cascading effect across the energy grid. High severity wildfires as well as prescribed fire have the potential to affect the capacity of water storage through accelerated erosion and sedimentation. Through fuel reduction and brush removal the Vegetation Treatment Program can reduce the risk of high severity fires occurring in areas that are likely to impact utilities or water supply. The following is a summary of key issues regarding the importance of the VTP to protect utilities and enhance energy production from a renewable source.

- Utilities such as transmission lines, substations, wind generation and potentially geothermal facilities are assets at risk, threatened by wildfire and escaped prescribed fire
- Hydro facilities generate electricity as well as store water. Vegetation management can increase runoff, which is favorable to electricity generation and storage, but it can also cause sedimentation that fills in reservoirs and block generators.
- Mechanical treatment of vegetation generates biomass. Some can be used for electricity generation or thermal applications that offset fossil fuel use.

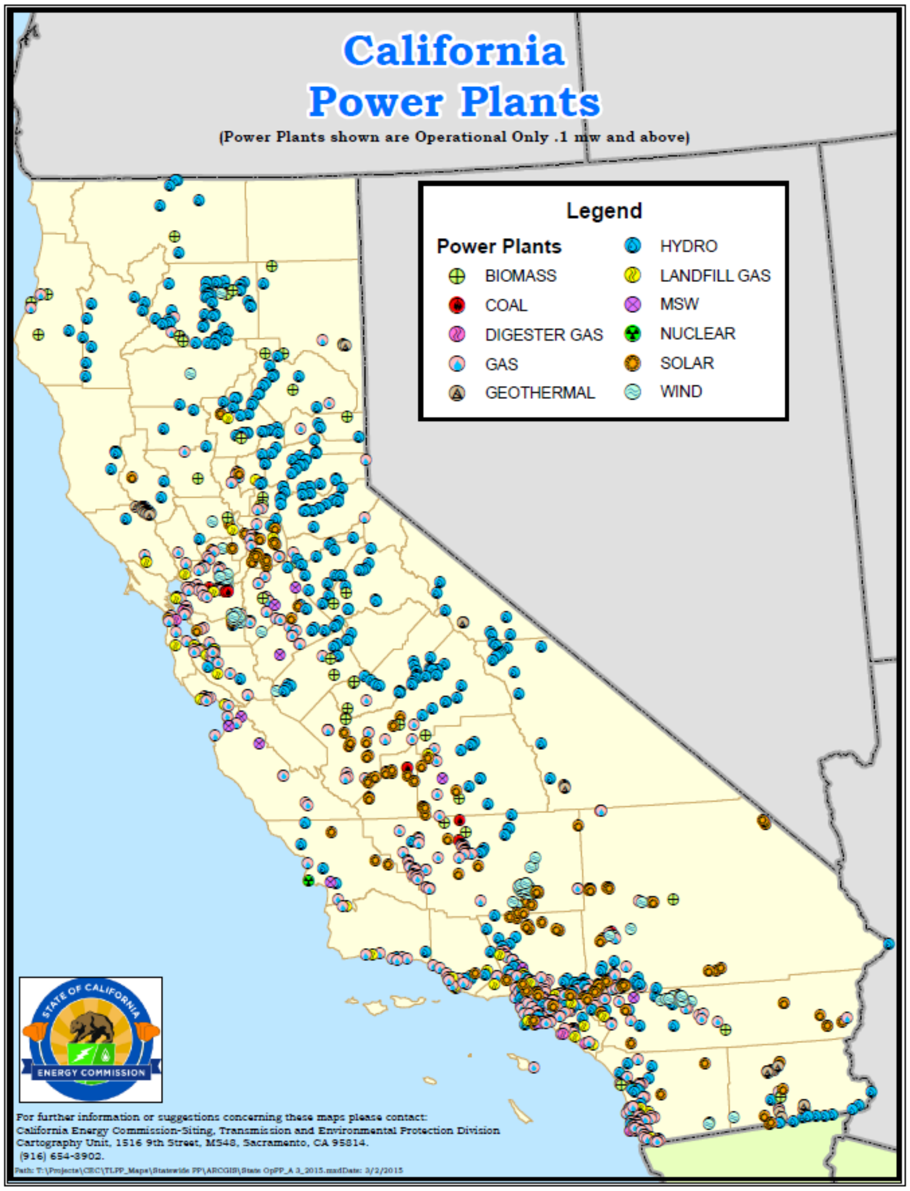


Figure 4.9-1 California Power Plants by type (CEC, 2013).

4.9.1.1 Regulatory Setting

A number of different agencies regulate utilities and energy production in California. These agencies do not have direct oversight over the Vegetation Treatment Program. However, their oversight and policy decisions can influence infrastructure needs which in turn may indirectly have a greater influence on the VTP. This would be particularly true if policy decisions lead to a greater emphasis on biomass and other renewable energy sources.

Potential Responsible Agencies include:

- California Energy Commission is the State's primary energy policy and planning agency. The Commission has major responsibilities that include: forecasting future energy needs, licensing thermal power plants 50 megawatts or larger, promoting energy efficiency, developing energy technologies and supporting renewable energy, and planning for and directing state response to energy emergency
- Public Utilities Commission (PUC) for projects requiring permits to construct an electric transmission line, a water utility, a radio-telephone utility, or facilities for operating a passenger transportation service
- California Electricity Oversight Board ensures transmission reliability through overseeing operations of the California Independent System Operator (CAISO), ensures fair market prices, and monitors daily market variations.
- California ISO is the impartial link between power plants and the utilities that serve more than 30 million consumers. The ISO provides equal access to the grid for all qualified users and strategically plans for the transmission needs of this vital infrastructure
- California Integrated Waste Management Board would be a Responsible Agency (or any other applicable enforcement agency) for projects requiring permits to operate a transfer, disposal, or waste-to-energy facility

4.9.1.2 **Electricity and Transmission Lines**

California’s electrical transmission and distribution system consists of power plants, substations, transmission lines, electric utility service areas, and electrical transmission busses. Power lines are a critical infrastructure of California’s energy system. Right-of-way corridors associated with transmission lines are normally between 150 to 300 feet wide (CEC, 2004). With about 54 thousand miles of transmission line in California (Figure 4.9-2), they represent a prominent and expanding infrastructure on the landscape. Table 4.9-1 provides a summary of the length of transmission lines by bioregion. With the increasing interest in renewable energy resources it is likely that additional transmission lines will need to be located in forest and range lands across the state. Wildfires have the potential to damage or destroy transmission lines. Depending on the extent of the damage the impact to transmission lines from a wildfire could have a cascading effect across the energy grid. Vegetation around utility facilities, especially transmission lines, is managed by the utility company to prevent tall trees and other vegetation from interacting with conductors and interfering with providing safe and reliable transmission of electricity.

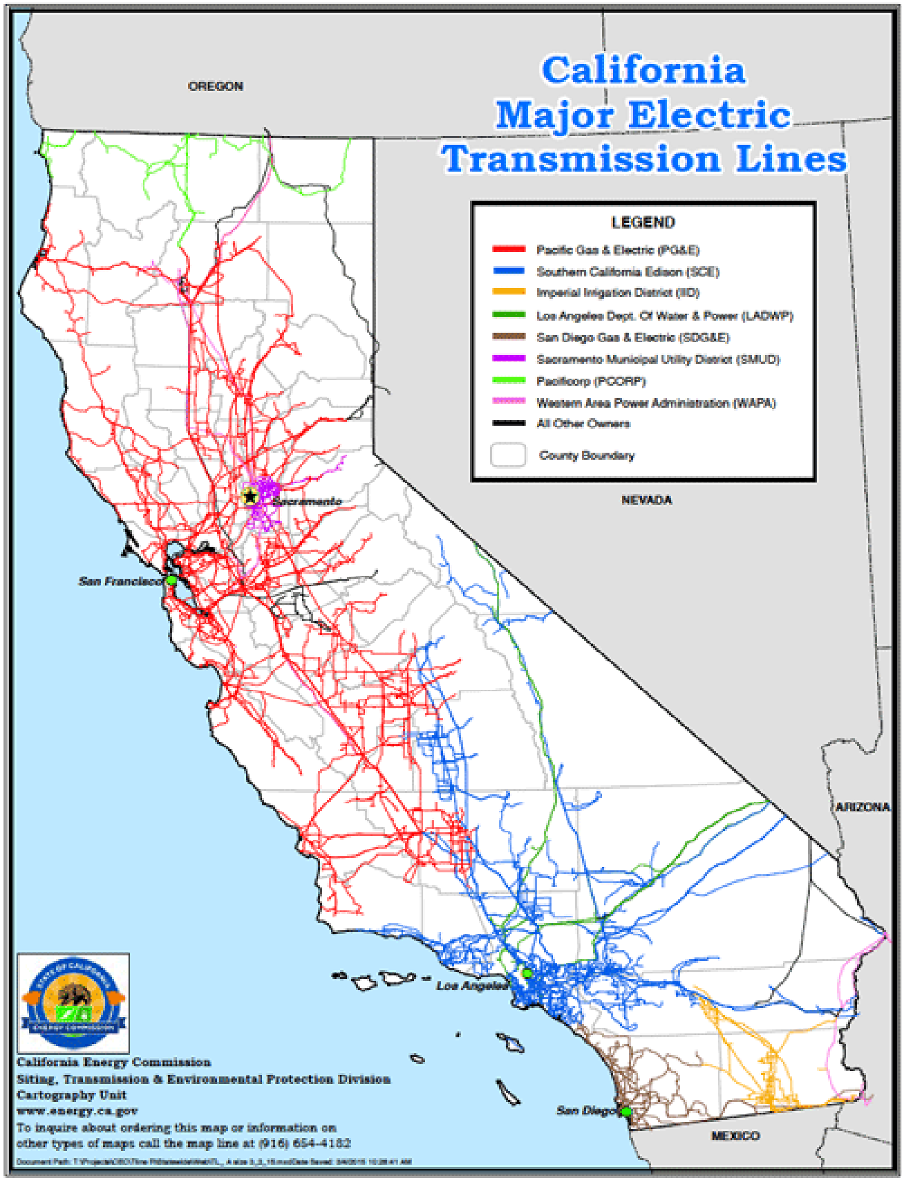


Figure 4.9-2 California's Major Electric Transmission Lines (CEC, 2014).

4.9.1.3 **Water Infrastructure**

To accommodate a large population and to account for highly variable rainfall, California has a highly developed water supply infrastructure. The California State Water Project consists of an extensive storage and conveyance system that includes pumping and power plants, reservoirs, lakes, storage facilities, aqueducts, canals, and pipelines that distribute water through 29 different water agencies. The location of dams, reservoirs, and canals reflects the spatial distribution of precipitation. Many of the dams are located in forest landscapes (Figure 4.9-3). The State's water is concentrated in the north; 75

percent of precipitation occurs north of Sacramento, but the majority of the urban population and much of the irrigated agriculture are in the south. California's water storage meets multiple objectives that include: compensating for annual and seasonal variations in water supply, providing fire protection, and providing recreational opportunities.

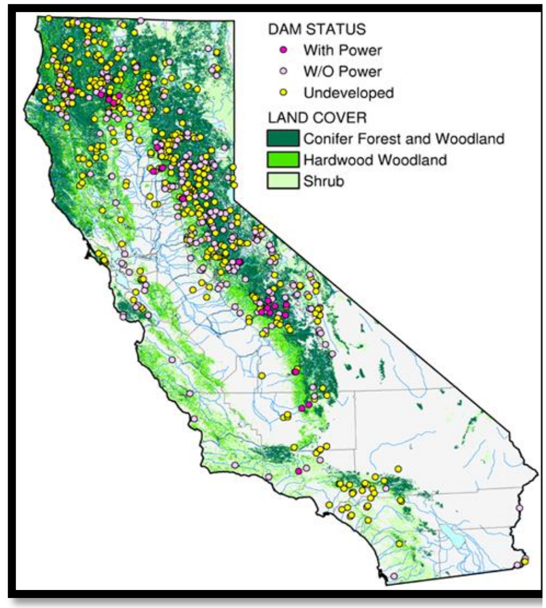


Figure 4.9-3 California dams and their power status. (DOE, 1998).

The two major water projects in California are the State Water Project and the Central Valley Water Project. The Oroville Dam is the main storage facility for the State Water Project. The two main storage facilities for the Central Valley Water Project are the Shasta Dam and the Friant Dam. In addition, there are an estimated 1,200 nonfederal dams with a reservoir capacity of 20 million acre feet (MAF) (Mount, 1995). Combined with 181 federal reservoirs, the total capacity is roughly 42 MAF and captures almost 60 percent of runoff. The water from these dams is distributed across the state through a complex system of canals and aqueducts that stretches for several thousand miles across the state. High severity wildfires have the potential to affect the capacity of water storage through accelerated erosion and sedimentation.

4.9.1.4 Energy Production and Use

With its large and growing population California consumes more energy (264,740 Gigawatt hours) than any other state. It is also a world leader in electricity created by renewable energy resources and energy conservation. California has the second-lowest per capita energy consumption of any of the 50 states (US EIA, 2012). This section describes the environmental setting for energy production that is developed on forest and range lands and is potentially affected by fuel reduction projects and wildfires.

California's forests and rangelands provide electrical generation from several sources. These include electricity from hydropower, geothermal, wind, biomass, and solar. Urban wood wastes also contribute to production of electricity to the extent they are buried in landfills and landfill gas is captured and used to help generate electricity.

California relies on three sources of energy—petroleum, natural gas, and electricity. California's power generation system is owned by numerous entities, with about 44 percent of total generation owned by investor-owned and municipal utilities plus other entities (CEC, 2001a).

The two largest suppliers for forest and rangeland areas are Pacific Gas and Electric (PG&E) and Southern California Edison (SCE). However, most of the existing power plants once owned by PG&E, San Diego Gas and Electric (SDG&E), and SCE were sold. New plant owners, as well as new plants that will be built in California, are not required to provide electricity to the State. Since deregulation in 1996, the CEC has approved applications for new large power plants that will generate about 20,000 megawatts (MWs). Another 20,000 MWs of proposed capacity is under review by the CEC or may be submitted by developers in the near future.

4.9.1.5 **Forest and range related energy industry structure**

California's electric generation comes from multiple sources (Table 4.9-2). In 2013, natural gas, coal, large hydro, and nuclear power comprised 80 percent of the fuel type used to generate electricity, while renewable sources (biomass, geothermal, small hydro, solar, and wind) accounted for 19 percent.

Energy contributions from forests and rangelands are primarily associated with electricity from hydropower, geothermal, wind, and biomass. Large hydro is not considered to be renewable and is defined as any facility employing one or more hydroelectric turbine generators, the sum capacity of which exceeds 30 MWs (CEC, 2001c). In contrast, small hydro (any facility employing one or more hydroelectric turbine generators with a sum capacity of 30 MW or less) is considered renewable. In 2001, renewables contributed 10.5 percent of California's electrical generation. Renewables include small hydro, biomass, geothermal, wind, and solar sources (Figure 4.9-4). The most significant contributions come from geothermal and biomass.

Hydro (both large and small), geothermal, biomass, and wind energy sources are related to forest and range resources. Over the last two decades, the relative importance of hydro, wind, biomass, and geothermal has varied. However over the last five years, the relative contribution of hydro has declined. Tables 4.9-2 and 4.9-3 summarize the amount and percent of megawatts produced from renewable sources.

In 2013, hydroelectric power accounted for roughly half of total renewable energy that was produced by in-state power plants. Other significant sources of in-state renewable energy are biomass (18 percent), geothermal (7 percent), wind (1 percent), and solar (28 percent).

Table 4.9-1 Gross system electricity production by resource type (CEC, 2013)

Fuel Type	California In-State Generation (GWh)	Percent of California In-State Generation	Northwest Imports (GWh)	Southwest Imports (GWh)	California Power Mix (GWh)	Percent California Power Mix
Coal	1,018	0.51%	812	21,363	23,193	7.82%
Large Hydro	20,754	10.39%	96	2,159	23,009	7.76%
Natural Gas	120,863	60.50%	1,241	9,319	131,423	44.31%
Nuclear	17,860	8.94%	0	8,357	26,217	8.84%
Oil	38	0.02%	0	0	38	0.01%
Other	14	0.01%	0	0	14	0.00%
Renewables	39,236	19.64%	13,187	3,256	55,679	18.77%
Biomass	6,423	3.21%	1,485	21	7,929	2.67%
Geothermal	12,485	6.25%	212	495	13,192	4.45%
Small Hydro	3,343	1.67%	470	0	3,813	1.29%
Solar	4,291	2.15%	58	1,040	5,389	1.82%
Wind	12,694	6.35%	10,962	1,700	25,356	8.55%
Unspecified Sources of Power	N/A	N/A	19,750	17,305	37,055	12.49%
Total	199,783	100.00%	35,086	61,759	296,628	100.00%

**Amount of electricity produced from coal includes out-of- State power plants that are either owned by California utilities or have long term contracts to supply electricity solely to California. This electricity produced from these coal-fired plants is not designated as an "import" even though the plants are located outside the State. The 15 small coal-fired power plants located within California have a name plate capacity of only 550 MWs; less than one percent of total State capacity. (CEC, 2013)*

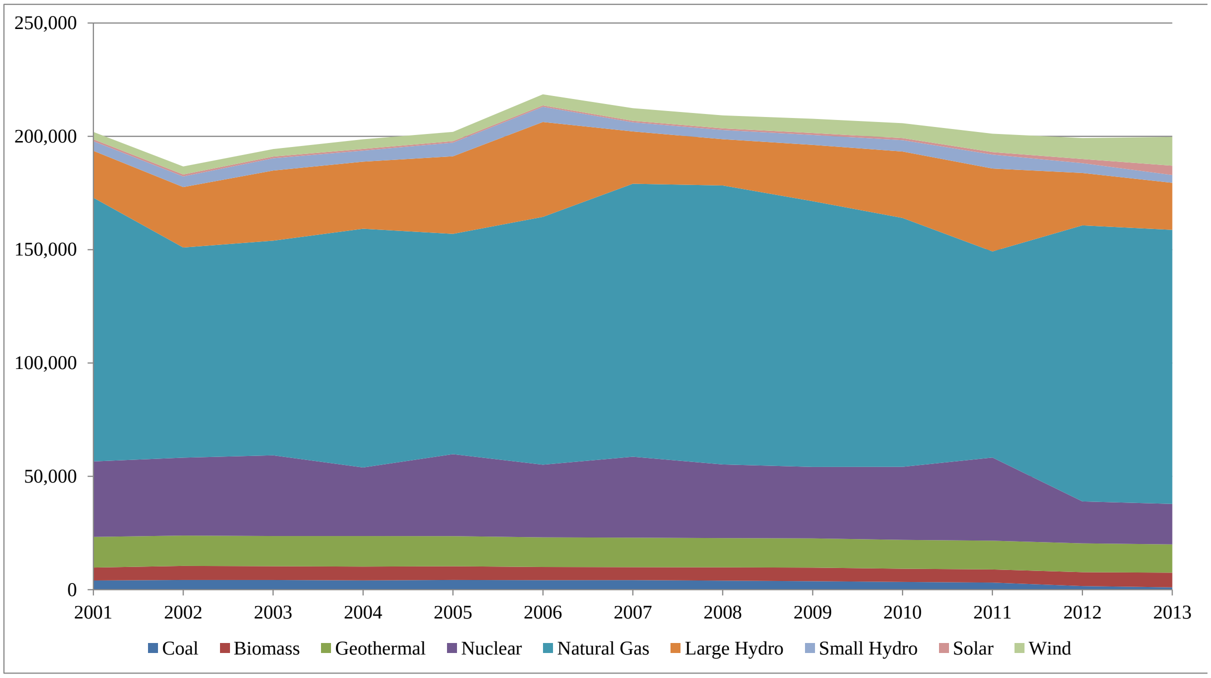


Figure 4.9-4 State wide annual total power generation by type (CEC, 2013).

Table 4.9-2 Megawatt production from online power plants by bioregion and plant type (CEC, 2013).

Bioregions	Geothermal	Hydro	Wind	Solar	Biomass	Bioregion Total
Bay Area/Delta	17	2	0	72	50	141
Central Coast	0	5	0	13	13	31
Colorado Desert	27	15	0	3	0	45
Klamath/North Coast	9	75	0	5	9	98
Modoc	0	1	0	0	2	3
Mojave	9	47	0	42	14	112
Sacramento Valley	0	44	0	46	11	101
San Joaquin Valley	0	26	0	15	2	43
Sierra Nevada	8	166	1	54	18	247
South Coast	0	42	0	22	58	122
Total by Power Plant	**70**	**423**	**1**	**272**	**177**	**943**

Table 4.9-3 Megawatt percentages from online power plants by bioregion and plant type (CEC, 2013).

Bioregions	Geothermal	Hydro	Wind	Solar	Biomass	Bioregion Total
Bay Area/Delta	24%	0%	0%	26%	28%	14.95%
Central Coast	0%	1%	0%	5%	7%	3.29%
Colorado Desert	39%	4%	0%	1%	0%	4.77%
Klamath/North Coast	13%	18%	0%	2%	5%	10.39%
Modoc	0%	0%	0%	0%	1%	0.32%
Mojave	13%	11%	0%	15%	8%	11.88%
Sacramento Valley	0%	10%	0%	17%	6%	10.71%
San Joaquin Valley	0%	6%	0%	6%	1%	4.56%
Sierra Nevada	11%	39%	100%	20%	10%	26.19%
South Coast	0%	10%	0%	8%	33%	12.94%

4.9.2 EFFECTS

4.9.2.1 Significance Criteria and Determination Thresholds

An impact to utilities and energy is considered to be significant if the proposed program or Alternatives would:

a) Cause substantial alterations to water, wastewater, or power systems.
b) Cause substantial disruption in utility service or access to public facilities.
c) Cause substantial damage to utilities, utility service or public facilities within the project area.

4.9.2.2 Data & Assumptions

The proposed Program or Alternatives do not fund any building projects or the development of any permanent facilities requiring power or water, and the implementation of the proposed Program does not require substantial disruptions to utility services. It is anticipated that some material generated by the proposed program might be removed to a biomass plant concurrent with program operation. Because the cost to remove such fuel is high, it is anticipated that no more than 10 percent of mechanical treatments might generate biomass, and only then when the material is chipped on site and only when the projects are near an existing biomass plant. Removal of material for commercial purposes is not covered under the Program EIR.

4.9.2.3 Direct Effects Common to all Bioregions From Implementing the Program/Alternatives

The primary mechanism by which the VTP program could have a significant adverse effect would be through an escaped prescribed burn damaging a water or energy facility. The mechanical, hand, herbicide, and herbivory treatments would all be confined to the project area. The effects of implementing the No Project or Alternatives

A-D are expected to be similar to the effects associated with implementing the Proposed Program but on scales equating to less acres. No water or energy facilities would be directly damaged by any of the Alternatives; however the goals of the Program EIR would not be achieved under any of the Alternatives. Determination of Significance

No significant impacts that would damage water or energy facilities from a project are expected from implementing the proposed Program. Significant effects are not expected as the odds of a prescribed fire escaping are very low, and the Project Scale Analysis will identify local impacts that are not detected at the scale of the bioregion.

No water or energy facilities would be directly damaged by any of the Alternatives; there are no significant impacts from implementing the No Project Alternative or Alternatives A-D.

4.9.2.4 Similar Effects Described Elsewhere

Impacts to wastewater treatment facilities due to erosion from projects are addressed in the water quality section 4.5. Impacts to transportation-related infrastructure can be found in Section 4.10.

4.9.3 MITIGATION AND STANDARD PROJECT REQUIREMENTS

No mitigation measures or standard project requirements are required. However, the following questions will be included in the Project Scale Analysis and may result in Project Specific Requirements.

PSA Item 4.9.1 Are there any transmission lines or other electrical, telecommunications, or water supply facilities in or near the project area? Protective measures need to be taken and may include installation of firebreaks using hand treatments around sensitive equipment.

PSA Item 4.9.2 If treatments will include digging below the surface of the ground to a depth of greater than 2 feet, project manager should contact local utilities to determine location of buried underground utilities.

4.10 TRANSPORTATION & TRAFFIC

Transportation and Traffic has been broken up into three sections:

- **4.10.1 – Affected Environment**
  - The Affected Environment section discusses the transportation setting in California as well as potential issues associated with transportation and traffic.
- **4.10.2 – Effects**

- The Effects section outlines the potential impacts of implementing the proposed Program and the Alternatives.

- **4.10.3 – Mitigations**
  - The Mitigation section provides the standard program requirements and project specific requirements that will reduce the likelihood of the proposed Program causing significant adverse impacts to transportation and traffic.

4.10.1 AFFECTED ENVIRONMENT

The purpose of the Transportation and Traffic section is to describe existing and future traffic circulation and parking patterns, and to evaluate the impact of the proposed project on these conditions. This evaluation should also consider project impacts on public transportation and alternative modes of transportation, such as bicycles, shuttles, and walkways. The VTP does not typically result in the construction of new roads or the modification of existing roads to conduct projects. However, the following section provides a brief discussion of the existing transportation system that the program operates under.

4.10.1.1 Responsible Agencies

The California Department of Transportation (Caltrans) would be a Responsible Agency for projects requiring permits for encroaching on land within its jurisdiction. Caltrans reviews projects to ensure that the proposed encroachment is compatible with the primary uses of the state highway system, and to protect the state's investment in the highway facility.

4.10.1.2 Setting

California has an extensive road network that supports a growing population that is projected will increase from 33.9 million residents in 2000 to about 48.6 million in 2025, a 44 percent increase (Institute of Transportation Studies, 2002). Table 4.10-1 identifies the miles of transportation within each bioregion. Local road systems make up the majority of all accountable transportation systems (87 percent); state and US highways only equate to 7 percent of the total. The amount of public roads in California is nearly equally divided between rural and urban areas (Table 4.10-2). With only 8 percent of California's population, rural areas comprise 94 percent of the land area. There are roughly 80,000 miles of rural roads in California. California's growing population places an increased demand on its transportation system. In the thirteen years between 1984 and 1997, at least 26,000 lane-miles of streets and highways were added to the entire road network statewide (California Research Bureau, Federal Highway Administration, and California Department of Transportation). The Interstate highway system grew by five percent and freeways and expressways off the Interstate system increased by 26 percent. Over that same period California's population grew 28 percent and the amount of driving increased by 45 percent.

Table 4.10-1 Extent of transportation system by bioregion (Source: Census, 2000)

Bioregion	Total Miles	Local Roads	Other	State Highways	US Highways	Trails	Rail
Bay Area/Delta	36,640	32,639	1,538	1,055	1,025	381	1323
Central Coast	25,246	20,510	1,470	1,163	712	1,390	428
Colorado Desert	13,251	11,291	253	601	431	675	531
Klamath/North Coast	42,165	37,549	1,258	1,159	554	1,637	680
Modoc	21,842	18,912	259	597	225	1,849	646
Mojave	39,995	34,650	415	1,404	694	2,832	1014
Sacramento Valley	18,035	16,258	586	555	383	252	692
San Joaquin Valley	40,426	34,425	3,600	1,333	822	246	1221
Sierra	48,416	41,418	1,828	2,168	810	2,192	591
South Coast	64,776	58,119	1,985	1,794	1,971	906	1447
Total	**350,791**	**305,772**	**13,194**	**11,829**	**7,628**	**12,361**	**8573**

In California's major metropolitan areas, where a majority of the State's residents live, new roadway capacity expansions have actually kept pace with population growth over the last fifteen years (while California's metropolitan areas' population has increased 28 percent since 1984, road capacity has increased by 24 percent). In reality, much of what has driven the recent growth in traffic congestion is an even sharper increase in driving (vehicle miles traveled), an exponential increase that cannot be explained by population expansion alone. Rather, the trend towards an increasing number of miles driven primarily reflects the trend towards lower-density residential and commercial development patterns that force people to drive more frequently over longer distances.

Rural areas in California face different transportation issues than urban areas. Rural areas comprise more than 90 percent of the land area, contain roughly half of the road miles in California, but represent less than 10 percent of the population (Caltrans, 2005; Table 4.10-2). As such, the burden of maintaining the transportation system across rural regions in California is greater.

Table 4.10-2 California Public Road Length, Miles By Functional System

	1995	2000	2005	2010	2012
Total rural and urban	170,389	168,076	169,906	172,139	175,499
Rural	87,869	83,428	84,473	82,046	80,870
Interstate	1,346	1,357	1,325	1,275	1,279
Other principal arterial	3,691	3,701	3,601	3,519	3,529
Minor arterial	6,911	6,969	6,727	6,685	6,681
Major arterial	13,058	13,100	12,470	12,837	12,615
Minor collector	9,114	8,781	8,371	8,206	7,865
Local	53,749	49,520	51,979	49,525	48,901
Urban	82,520	84,648	85,433	90,092	94,629
Interstate	1,076	1,096	1,135	1,178	1,174
Other freeways and expressways	1,328	1,343	1,494	1,526	1,497
Other principal arterial	5,860	5,939	6,198	6,476	6,687
Minor arterial	10,292	10,435	10,456	10,776	10,980
Collector	10,034	10,039	11,028	11,374	11,696
Local	53,930	55,796	55,122	58,763	62,594

4.10.1.3 Environmental Issues

Air quality and greenhouse gas emissions are the predominant environmental impacts associated with transportation. This is closely tied to energy consumption by cars, trucks, and other modes of transportation. The transportation sector accounts for roughly 35 percent of all energy used in California (U.S. DOE, 2002). The burning of fossil fuels for transportation is estimated to represent 60 percent of all greenhouse gases. A growing population combined with a trend toward longer commutes will likely further degrade air quality without changes in fuel consumption and our dependence on petroleum as a primary source of energy, and current modes of transportation. Other environmental impacts associated with transportation include:

- Water Quality – can be degraded through storm water runoff from roads and other impermeable surfaces.
- Vegetation – can be impacted through direct removal due to new roads as well as impairments from transportation generated air pollution.
- Wildlife habitat – road systems increase fragmentation and can degraded existing habitat.
- Open space – transportation can either directly or indirectly (i.e. growth induced) lead to losses in the amount of open space.

4.10.2 EFFECTS

This section summarizes the impacts on transportation and traffic due to implementing either the proposed Program or any of the Alternatives. Only the effects of traffic volume were analyzed. Issues related to road design, parking, air traffic patterns, or alternative transportation are not applicable to the potential effects from VTP treatments.

4.10.2.1 Significance Criteria

An effect will be considered significant if results of the analysis indicate that any of the following criteria will be met due to implementation of the Program or Alternatives:

a) An increase in traffic that is substantial in relation to the existing traffic load and capacity of the street system (i.e., result in a substantial increase in either the number of vehicle trips, the volume to capacity ratio on roads, or congestion at intersections)
b) Exceed, either individually or cumulatively, a level of service standard established by the county congestion management agency for designated roads or highways.

4.10.2.2 Determination Threshold

The following threshold is used to determine whether there is a significant impact to local residential or commercial development resulting from traffic generated by the Program or any of the Alternatives:

a) Traffic increases in excess of 10 percent Average Daily Trips (ADT) of the capacity of roads that serve residential and/or commercial areas appurtenant to the project.

4.10.2.3 Impacts on Transportation and Traffic from Implementing the Program or Alternatives

The potential effects on traffic and transportation resulting from implementing the Program or Alternatives are expected to be of short duration (less than2 weeks) and limited to the time periods during which work is actually occurring on the project(s). Most projects occur in remote areas and background traffic levels on these roads is generally far below the capacity of the roads. Therefore the effects of increased traffic levels due to VTP projects were analyzed relative to the communities in nearest proximity to the potentially treated areas. Consequently, there were negligible effects from prescribed fire, mechanical, manual, herbicide, and herbivore treatments through all of the bioregions.

It is unlikely that a single residential or commercial area will be affected by the traffic from more than one treatment annually. Furthermore, in an area where multiple treatments could occur within one year, the likelihood of all treatments occurring simultaneously is low. Therefore at most, the nearest residential or commercial area to a VTP treated watershed would be affected by two simultaneous projects.

The number of vehicles required for each treatment type is expected to vary from one to two light trucks every few days for a prescribed herbivory treatment, up to 10 vehicles per day for a large prescribed burn or hand thinning treatment. Most of the vehicles used on VTP projects will be used for transporting people or fire equipment, with a small number of heavy trucks required at the beginning and end of some projects to transport heavy machinery (dozers, masticators, etc.) or livestock. There will not be regular heavy truck traffic to transport logs, as few if any logs will be removed from VTP projects in most all cases. Most projects will likely have 5-10 vehicles traveling to and from the work site each day, for total of 10-20 ADT per project.

The areas' most sensitive to the increased traffic levels from VTP projects are likely to be two-lane, low volume roads that pass through residential and commercial areas to and from project sites. Low volume roads are typically designed to handle less than 400 ADT (AASHTO, 2001). Assuming that the same road carries the traffic for two VTP projects simultaneously, 20-40 ADT would be generated. This would not result in a greater than 10 percent increase in the maximum capacity of the typical low volume road that is likely to service most VTP projects sites. Traffic levels on the wide variability of low volume roads statewide cannot be accurately predicted, however, traffic levels/patterns occurring on VTP projects are expected to be similar statewide.

The potential impacts to communities may be different between bioregions, depending on existing traffic levels. Predominantly rural bioregions such as the Colorado Desert, Modoc, and Mojave have lower existing traffic volumes than predominantly urban bioregions like the South Coast and Bay Area/Delta. Nevertheless, at the bioregion scale, VTP projects are not expected to result in a net increase in traffic volumes. Most vehicles used in VTP projects will be traveling to the site from within the same bioregion and were likely already in use somewhere else in the bioregion prior to working on the VTP project. Project evaluation through the Project Scale Analysis will identify any local significant impacts that are not detected at the scale of the bioregion.

4.10.2.4 Determination of Significance

The impacts to transportation and traffic from the proposed Project and any of the Alternatives are expected to be **less than significant** with the application of the SPRs below and any identified PSRs. SPRs TRA-1 and TRA-2 keep roadways clear of dust and smoke during any prescribed fire operations. TRA-1 informs road users of the prescribed fire project in the area, keeping them alert for smoke, and TRA-2 requires traffic control operations be implemented if dust or smoke impair roadway visibility. Traffic control operations ensure the safety of road users throughout the project implementation period.

The No Project alternative would apply to a landscape that is larger than the proposed Program, but due to costs, time constraints, and other limitations, it is anticipated that a smaller amount of acreage would actually be treated each year. Because of this, it is not likely to cause significant impacts to transportation and traffic.

Alternative A would treat a smaller landscape as the Proposed Program, but treat the same number of acres. Because projects would only be allowed in the WUI, Alternative A is more likely to result in simultaneous projects occurring in or near a particular community, and therefor likely to cause significant transportation and traffic impacts.

Similarly, Alternative B would treat a smaller landscape but the same number of acres as the Proposed Program, but only allow WUI and fuel break projects. Due to the limited types of projects that could be implemented, it is more likely that, under Alternative B, a community would have more than one simultaneous fuel reduction project occur, and therefor impacts to transportation and traffic are likely to be significant.

Alternative C would also treat a smaller landscape but the same number of acres as the Proposed Program. This Alternative would limit projects to VHFHSZ, which are determined by the existing fuels, topography, weather/climate, crown fire potential, and ember production and movement. Because this Alternative would exclusively focus projects in areas of high hazard and not human development (as in Alternatives A and B), with the mitigation measures proposed below Alternative C would not likely result in significant transportation and traffic impacts.

Alternative D would treat the same landscape as the Proposed Program but treat a smaller amount of acres due to the reduction of the use of prescribed fire. However, the reduction in prescribed fire is not replaced entirely by increases in other treatment methods, and so the overall transportation and traffic impacts are less. Because of the overall smaller treatment area proposed, and with the mitigation measures proposed below, Alternative D would not result in significant transportation and traffic impacts.

4.10.2.5 Similar Effects Described Elsewhere

Traffic and transportation effects are also described in Section 4.11, Population, Employment, Housing, and Socio-economic Wellbeing.

4.10.3 MITIGATION AND STANDARD PROJECT REQUIREMENTS

Under this analysis there are no mitigations. However, several Standard Project Requirements have been developed as part of the project design.

TRA-1: Public road ways leading into project area shall be signed to warn traffic of the project activities that are taking place. Road signage shall be posted the morning prior to the commencement of burning operations and shall remain until all operations are completed.

TRA-2: Direct smoke and dust impacts to roadway visibility and the indirect distraction of operations shall be considered during burning operations. Traffic control operations shall be implemented if weather conditions inhibiting smoke and dust dispersion have the potential to impact roadway visibility to motorists.

4.11 POPULATION, EMPLOYMENT, HOUSING, AND SOCIO-ECONOMIC WELLBEING

Population, Employment, Housing and Socio-Economic Wellbeing has been broken up into three sections:

- **4.11.1 – Affected Environment**
  - The Affected Environment section discusses the demographic setting of California and projected changes.
- **4.11.2 – Effects**
  - The Effects section outlines the potential impacts of implementing the proposed Program and the Alternatives.
- **4.11.3 – Mitigations**
  - The Mitigation section provides the standard program requirements and project specific requirements that will reduce the likelihood of the proposed Program causing significant adverse impacts to population, employment, housing, or socio-economic wellbeing.

4.11.1 AFFECTED ENVIRONMENT

This section describes the environmental setting for population, employment, housing, and socio-economic wellbeing. Demographic trends across California can greatly affect natural resource availability and use. In addition, increasing population in the foothill counties of the Sierra and rural forested areas in Southern California has increased the likelihood of exposure of people and homes to wildland fires. In addition, this section summarizes the impacts to population, employment, housing, and socio-economic wellbeing due to implementing either the Proposed Program or any of the Alternatives.

California is comprised of 58 counties and has a population estimated at 37,253,956 (U. S. Census Bureau, 2011). Of the 50 States, California is the most urban, with 95 percent of its population living in the urban area that comprises about five percent of the land. Urban lands can be incorporated or unincorporated areas, with the unincorporated areas generally being less populated and on the fringe of metropolitan areas. Approximately 17 percent of the population lives in unincorporated areas, which constitute roughly 80 percent of the total land area (U.S. Census Bureau, 2011). In recent history, California's population has dwarfed that of all other states, and the population growth has consistently outpaced the rest of the United States. California is home to seven of the nation's ten most densely populated urban areas. The nation's most densely populated area is Los Angeles-Long Beach-Anaheim, populated by close to 7,000 people per square mile. This is followed by San Francisco-Oakland (6,266 people per square mile), San Jose (5,820 people per square mile, and Delano (5,483 people per square mile) (U. S. Census Bureau, March 2012). The following section describes population trends statewide and for each of the bioregions in California. Although there have been some trends towards increasing population in the interior portions of California (i.e. Central Valley) the majority of the population (about 80 percent) still resides in coastal counties.

4.11.1.1 Population growth and extent

California is the most populous state in the nation and continues to grow. Over the past decade the state has grown by 10 percent, slightly outpacing the 9.7 percent average growth nationwide. However, since the economic downturn of 2008, its rate of growth has slowed considerably. In fact, net figures show that 1.5 million more people left the state than immigrated to it over the past decade. According to the Pew Hispanic Center (April 2012) there has been a significant drop in illegal and legal immigration from Mexico due to a weak U.S economy, lack of jobs, increased deportation, increased border patrols, and decreased birth rates. Thus the recent growth in population has been due solely to natural increase – more in-state births than deaths. While the vast majority of Californians live in urban areas, a large portion of the state resides in rural counties. These rural cities and counties are in some cases growing at a faster rate than the major urbanized areas.

As residential and commercial land use continues to encroach on natural landscapes, population growth will influence the state's natural ecosystems in several ways. First, continued population growth necessitates the use and development of increasing areas of forests and particularly rangelands for people to live and work in. Second, the greater ethnic diversity, an aging population, and increasing incomes further drive new and varied demands for open space, outdoor recreation, natural reserves, and working landscapes that provide employment opportunities. Third, most Californians live in urban areas. This urban population drives attitudes and preferences that influence the willingness to support management goals and investment in forests and rangelands.

The majority of Californians live in areas characterized by dense development. As of 2010, about 80 percent of California's 37.3 million people lived within the boundaries of census blocks averaging at least one housing unit per acre (U.S. Census Bureau, 2010). In 2011, California had 18 cities with a population over 200,000 and 69 cities exceeding 100,000. The California Department of Finance (DOF) reports that roughly one quarter of all Californians (9.4 million) live in the ten largest cities (California

Department of Finance, 2011). California has experienced continuing population growth of about 10 percent from 2000 to 2010 (on average about a 1 percent annual growth rate).

California's population growth over the past decade has not been equally distributed across all bioregions. Of the 58 counties in the State, 55 had population growth during the time period of 2000-2010, and three counties, all in the Sierra bioregion, experienced population declines over the decade. On a bioregion level, the Mojave, Sierra, Colorado Desert, and San Joaquin bioregions all experienced overall growth rates that equaled or exceeded 20 percent over that period, or about twice the state average (Table 4.11-1).

Table 4.11-1 Past population growth in California by bioregion and county 2000-2010 (California DOF, 2013).

Bioregion/ County	2000	2010	Percent Change
California	**33,871,653**	**37,253,956**	**9.99%**
Bay Area/Delta			
Alameda	1,443,741	1,510,271	4.61%
Contra Costa	948,816	1,049,025	10.56%
Marin	247,289	252,409	2.07%
Napa	124,279	136,484	9.82%
San Francisco	776,733	805,235	3.67%
San Mateo	707,163	718,451	1.60%
Santa Clara	1,682,585	1,781,642	5.89%
Solano	394,542	413,344	4.77%
Sonoma	458,614	483,878	5.51%
	6,783,762	7,150,739	5.41%
Central Coast			
Monterey	401,762	415,057	3.31%
San Benito	53,234	55,269	3.82%
San Luis Obispo	246,681	269,637	9.31%
Santa Barbara	399,347	423,895	6.15%
Santa Cruz	255,602	262,382	2.65%
Ventura	753,197	823,318	9.31%
	2,109,823	2,249,558	6.62%
Colorado Desert			
Imperial	142,361	174,528	22.60%
	142,361	174,528	22.60%
Klamath/North Coast			
Del Norte	27,507	28,610	4.01%
Humboldt	126,518	134,623	6.41%
Lake	58,309	64,665	10.90%
Mendocino	86,265	87,841	1.83%
Siskiyou	44,301	44,900	1.35%
Trinity	13,022	13,786	5.87%
	355,922	374,425	5.20%
Modoc			
Lassen	33,828	34,895	3.15%
Modoc	9,449	9,686	2.51%
	43,277	44,581	3.01%
Mojave			
Riverside	2,194,933	2,323,527	5.86%
San Bernardino	2,039,040	2,116,461	3.80%
	4,233,973	4,439,988	4.87%

Bioregion/ County	2000	2010	Percent Change
Sacramento Valley			
Butte	203,171	220,000	8.28%
Colusa	18,804	21,419	13.91%
Glenn	26,453	28,122	6.31%
Sacramento	1,223,499	1,418,788	15.96%
Shasta	163,256	177,223	8.56%
Sutter	78,930	94,737	20.03%
Tehama	56,039	63,463	13.25%
Yolo	168,660	200,849	19.09%
Yuba	60,219	72,155	19.82%
	1,999,031	2,296,756	14.89%
San Joaquin Valley			
Fresno	799,407	930,450	16.39%
Kern	661,645	839,631	26.90%
Kings	129,461	152,982	18.17%
Madera	123,109	150,865	22.55%
Merced	210,554	255,793	21.49%
San Joaquin	563,598	685,306	21.59%
Stanislaus	446,997	514,453	15.09%
Tulare	368,021	442,179	20.15%
	3,302,792	3,971,659	20.25%
Sierra Nevada			
Alpine	1,208	1,175	-2.73%
Amador	35,100	38,091	8.52%
Calaveras	40,554	45,578	12.39%
El Dorado	156,299	181,058	15.84%
Inyo	17,945	18,546	3.35%
Mariposa	17,130	18,251	6.54%
Mono	12,853	14,202	10.50%
Nevada	92,033	98,764	7.31%
Placer	248,399	348,432	40.27%
Plumas	20,824	20,007	-3.92%
Sierra	3,555	3,240	-8.86%
Tuolumne	54,504	55,365	1.58%
	700,404	842,709	20.32%
South Coast			
Los Angeles	9,519,338	9,818,605	3.14%
Orange	2,846,289	3,010,232	5.76%
San Diego	2,813,833	3,095,313	10.00%
	15,179,460	15,924,150	4.91%

The top ten fastest growing counties between 2000 and 2010 had average annual growth rates ranging from 2 percent in Yuba to 4.2 percent in Riverside County. While most of the fastest growing counties have extensive areas of forest and rangeland, three forest and rangeland counties did not grow – Plumas, Sierra and Alpine counties all experienced declining populations over the period.

In the last decade, California's ten largest cities experienced population changes ranging from -2.2 to 40.7 percent, while a number of small to moderate-sized cities experienced the highest relative growth rates. The ten fastest growing cities had average annual percentage changes ranging from 7.9 to 28.2 percent, with an average of 12.9 percent growth (Table 4.11-2). City annexations and housing construction prior to 2008 are due in part to these high growth rates. Each year, these factors combine to result in a different set of small and medium sized cities experiencing high growth.

Table 4.11-2 Percentage change of the top ten fastest growing California cities (California DOF, 2013)

	Total Population		Change, 2000-2010	
State / County / City	April 1, 2000	April 1, 2010	Number	Percent
Lincoln city	11,205	42,819	31,614	282.1%
Beaumont city	11,384	36,877	25,493	223.9%
Murrieta city	44,282	103,466	59,184	133.7%
Brentwood city	23,302	51,481	28,179	120.9%
American Canyon city	9,774	19,454	9,680	99.0%
Imperial city	7,560	14,758	7,198	95.2%
Perris city	36,189	68,386	32,197	89.0%
San Jacinto city	23,779	44,199	20,420	85.9%
Victorville city	64,029	115,903	51,874	81.0%
Lake Elsinore city	28,928	51,821	22,893	79.1%

4.11.1.2 Population projections

California's total population has grown consistently since the 1850s, and projections show that strong growth will likely continue (Figure 4.11-1). Between 2010 and 2020, population is projected to grow at about 1.4 percent per year, with the result that California is projected to have about 40 million residents by the end of the decade (California DOF, 2013).

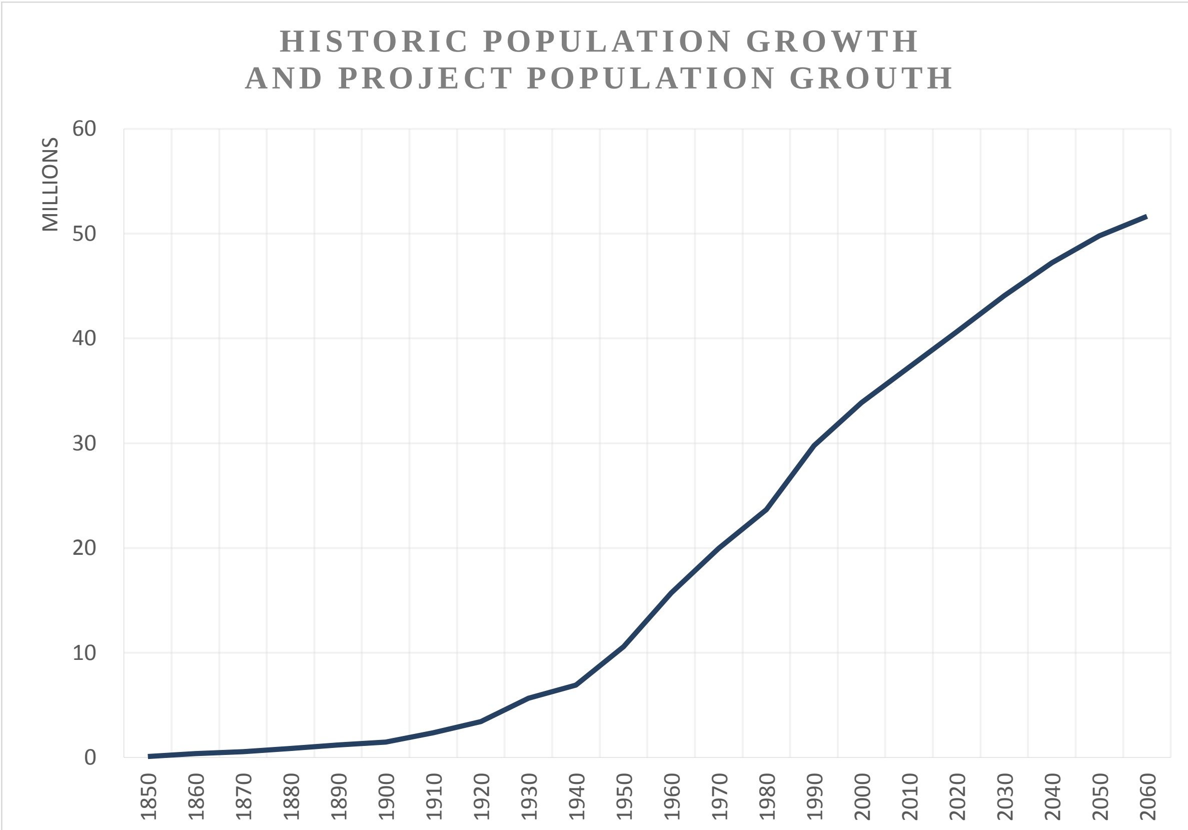


Figure 4.11-1 Historic and projected population growth in California, 1850-2050 (California DOF, 2013).

The population in forest and rangeland counties increased from 5.6 million people to 6.3 million (about 13.4 percent) between 2000 and 2010, and is expected to increase to over 7.8 million in 2020. This is an average annual rate of 2.0 percent per year, or about double that for the state taken as a whole. While the Sierra Bioregion overall is growing at a higher rate than the statewide average, there is significant variation among the counties that make up that bioregion. In Figure 4.11-2, counties in orange and red are projected to grow at a faster rate.

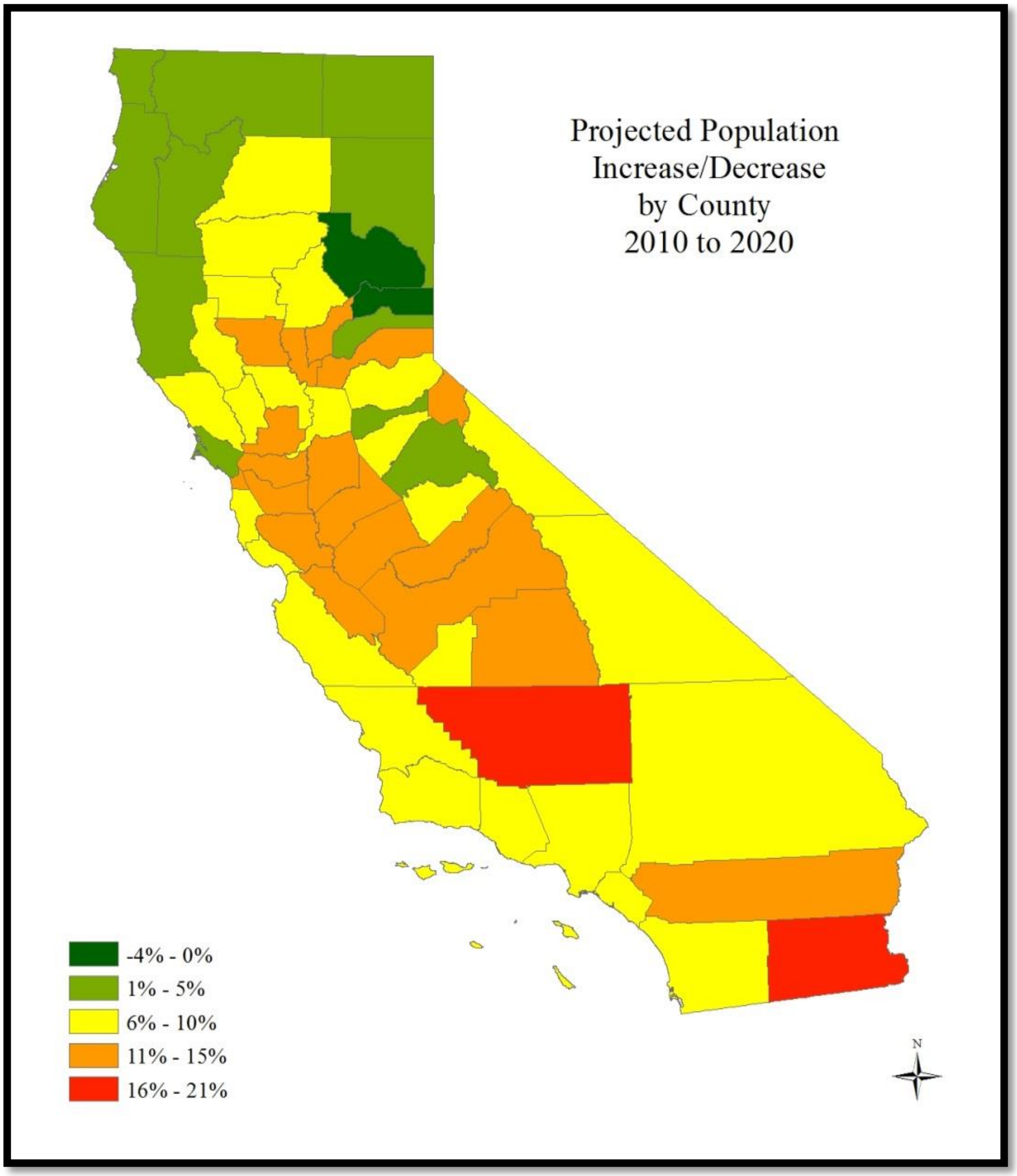


Figure 4.11-2 Projected rate of county population increase/decrease 2010-2020. (California DOF, 2013)

Counties were grouped into bioregions to determine population projections on a regional basis (Figure 4.11-3). For example, the Sierra Nevada bioregion is an area where a rapidly growing population will have impacts on the extensive forests and rangelands. In the next decade, the Sierra bioregion population is expected to increase 21 percent from 843,000 to 1.02 million people. Table 4.11-3 shows the projected county-based population increases from 2010 to 2020 for all bioregions in the state. Overall, growth is projected to be greatest away from the coast, in interior bioregions with much forest and rangeland.

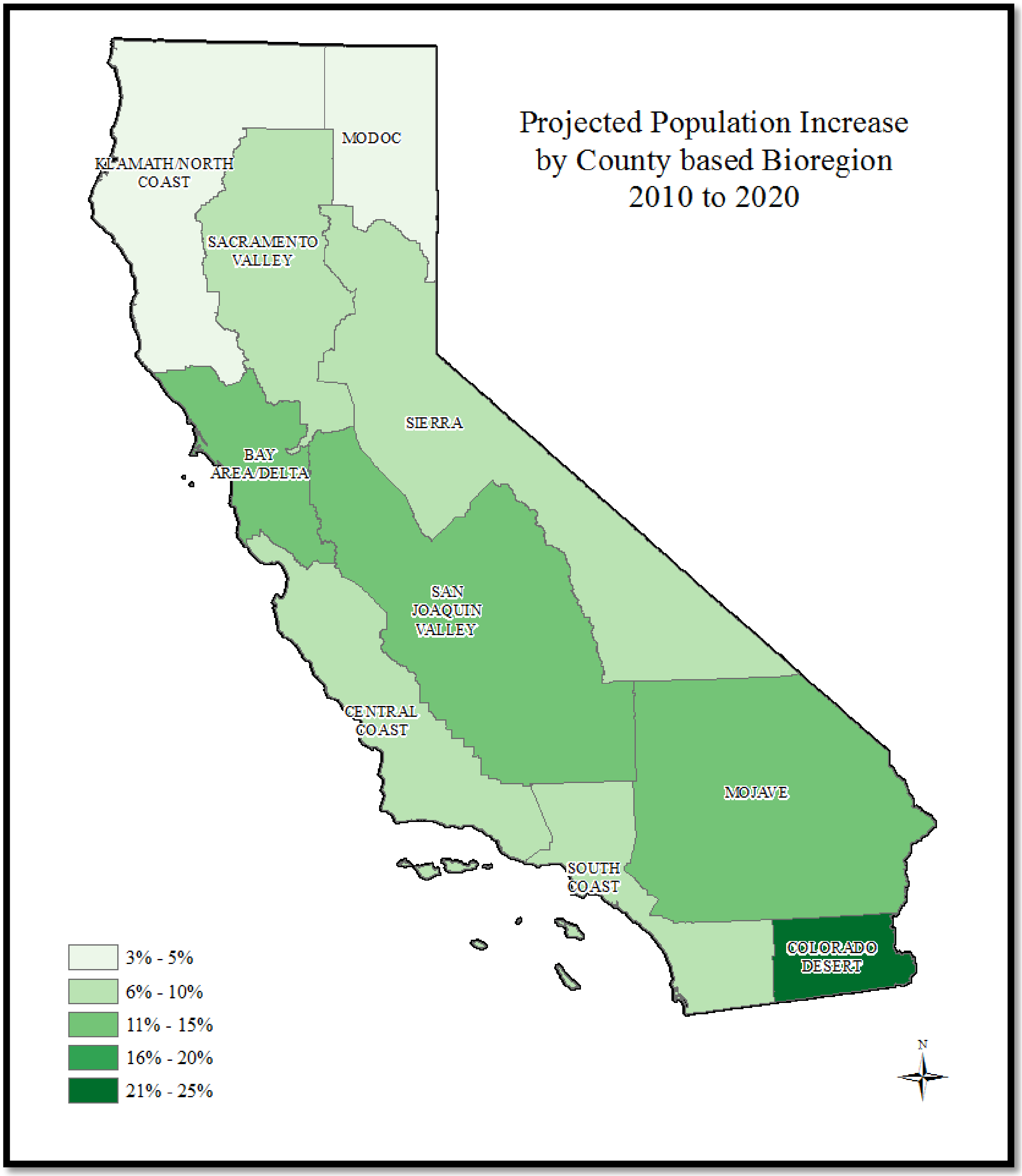


Figure 4.11-3 Projected rate of population increase by county-based bioregion 2010 t0 2020 (DOF, 2013).

Table 4.11-3 Projected population growth by bioregion and county 2010-2020 (California DOF, 2013).

Bioregion/ County	2010	2020	Percent Change
California	**37,253,956**	**40,619,346**	**9.03%**
Bay Area/Delta			
Alameda	1,510,271	1,682,348	11.39%
Contra Costa	1,049,025	1,166,670	11.21%
Marin	252,409	259,794	2.93%
Napa	136,484	146,869	7.61%
San Francisco	805,235	891,493	10.71%
San Mateo	718,451	777,088	8.16%
Santa Clara	1,781,642	1,970,828	10.62%
Solano	413,344	454,800	10.03%
Sonoma	483,878	523,615	8.21%
	7,150,739	7,873,505	10.11%
Central Coast			
Monterey	415,057	446,258	7.52%
San Benito	55,269	63,418	14.74%
San Luis Obispo	269,637	283,667	5.20%
Santa Barbara	423,895	455,858	7.54%
Santa Cruz	262,382	281,870	7.43%
Ventura	823,318	876,124	6.41%
	2,249,558	2,407,195	7.01%
Colorado Desert			
Imperial	174,528	211,973	21.46%
	174,528	211,973	21.46%
Klamath/North Coast			
Del Norte	28,610	29,146	1.87%
Humboldt	134,623	139,033	3.28%
Lake	64,665	70,690	9.32%
Mendocino	87,841	90,411	2.93%
Siskiyou	44,900	46,217	2.93%
Trinity	13,786	14,234	3.25%
	374,425	389,731	4.09%
Modoc			
Lassen	34,895	36,386	4.27%
Modoc	9,686	9,691	0.05%
	44,581	46,077	3.36%
Mojave			
Riverside	2,189,641	2,478,059	13.17%
San Bernardino	2,035,210	2,227,066	9.43%
	4,224,851	4,705,125	11.37%
Sacramento Valley			
Butte	220,000	236,936	7.70%
Colusa	21,419	24,291	13.41%
Glenn	28,122	30,466	8.34%
Sacramento	1,418,788	1,554,022	9.53%
Shasta	177,223	187,524	5.81%
Sutter	94,737	105,107	10.95%
Tehama	63,463	67,336	6.10%
Yolo	200,849	219,415	9.24%
Yuba	72,155	81,467	12.91%
	2,296,756	2,506,564	9.13%
San Joaquin Valley			
Fresno	930,450	1,055,106	13.40%
Kern	839,631	989,815	17.89%
Kings	152,982	167,465	9.47%
Madera	150,865	173,146	14.77%
Merced	255,793	288,991	12.98%
San Joaquin	685,306	766,644	11.87%
Stanislaus	514,453	573,794	11.53%
Tulare	442,179	498,559	12.75%
	3,971,659	4,513,520	13.64%
Sierra Nevada			
Alpine	1,175	1,296	10.30%
Amador	38,091	39,108	2.67%
Calaveras	45,578	48,957	7.41%
El Dorado	181,058	190,850	5.41%
Inyo	18,546	19,622	5.80%
Mariposa	18,251	19,316	5.84%
Mono	14,202	15,147	6.65%
Nevada	98,764	101,767	3.04%
Placer	348,432	396,203	13.71%
Plumas	20,007	19,284	-3.61%
Sierra	3,240	3,174	-2.04%
Tuolumne	55,365	55,993	1.13%
	842,709	910,717	8.07%
South Coast			
Los Angeles	9,818,605	10,435,991	6.29%
Orange	3,010,232	3,243,261	7.74%
San Diego	3,095,313	3,375,687	9.06%
	15,924,150	17,054,939	7.10%

4.11.1.3 Housing Issues and Trends

During the 1980s and 1990s, construction of new housing units showed a long-term overall decline in California. New construction picked up during the housing and real estate boom of the early 2000s. With the collapse of the housing market and subsequent economic recession, beginning in the years 2007-2008, California was hit very hard in numerous areas, and recovery in the construction industry since then has been stalled or slow. Still over the decade, California added 1.5 million new housing units (2010 Census Briefs: Housing Characteristics).

In the years just prior to the collapse, inflated housing prices fueled booms in home sales and prices, as well as new home construction. Prior to the bust, in 2004, nearly 213,000 new homes and apartments were built – the highest level since 1989 (Department of Housing and Community Development, 2006). June of 2006 still saw over 13,000 new housing starts. But just two years later in that same month, the number had plummeted to around 4,000 – a nearly 70 drop. New starts have continued to decline significantly, and in 2011 have hovered between one thousand and two thousand per month.

In California there has been a trend towards increased development in rural communities (FRAP, 2002). A total of 11.8 million homes are located in the Wildland Urban Interface (WUI). Of this, 4.9 million housing units (42 percent) are exposed to High or greater Fire Threat. Furthermore, of these, 4.1 million homes (84 percent) are from urban areas, where density of housing units exceeds one unit per acre. Thus while the land area considered WUI is dominated by areas of relatively low development density, the majority of houses at risk come from urbanized areas.

Table 4.11-4 provides a county-based summary of acres by housing density and land use class for each Bioregion. Using the 2010 census data housing unit density was classified into the following four categories, where all classes other than wildlands would be considered as potential WUI:

- Wildland (less than 1 unit per 20 acres)
- Rural (1 or more units per 20 acres and less than one unit per 5 acres).
- Interface (1 or more units per five acres and less than one unit per acre
- Urban (1 or more units per acre).

Table 4.11-4 Acres by Housing Density and Land Use Classes (Census, 2010)

Bioregion/ County	Wildland	Rural	Interface	Urban	Total
California	93,685,359	3,158,387	1,748,394	2,642,052	101,234,192
Bay Area/Delta					
Alameda	405,109	6,640	22,334	90,666	524,749
Contra Costa	354,152	18,721	42,312	99,766	514,951
Marin	327,050	6,171	16,430	29,330	378,981
Napa	447,603	35,955	10,796	11,465	505,819
San Francisco	49,204	245	705	18,724	68,878
San Mateo	273,644	13,237	20,185	46,302	353,368
Santa Clara	633,427	49,945	38,973	113,567	835,912
Solano	512,812	20,133	14,203	34,998	582,146
Sonoma	794,017	122,615	68,892	39,836	1,025,360
	3,797,018	273,662	234,830	484,654	4,790,164
Central Coast					
Monterey	1,996,860	63,648	34,274	25,531	2,120,313
San Benito	861,772	2,012	4,124	3,527	871,435
San Luis Obispo	2,004,781	55,921	40,442	23,759	2,124,903
Santa Barbara	1,673,285	32,421	21,978	31,581	1,759,265
Santa Cruz	162,438	71,311	33,334	18,556	285,639
Ventura	1,052,757	36,736	33,543	63,402	1,186,438
	7,751,893	262,049	167,695	166,356	8,347,993
Colorado Desert					
Imperial	2,824,527	20,271	11,220	11,858	2,867,876
	2,824,527	20,271	11,220	11,858	2,867,876
Klamath/North Coast					
Del Norte	625,271	11,206	10,779	1,835	649,091
Humboldt	2,200,757	56,590	23,627	12,619	2,293,593
Lake	791,250	33,346	18,769	8,302	851,667
Mendocino	2,150,641	64,958	28,298	4,766	2,248,663
Siskiyou	4,011,886	33,188	14,002	3,810	4,062,886
Trinity	2,018,988	28,025	5,654	714	2,053,381
	11,798,793	227,313	101,129	32,046	12,159,281
Modoc					
Lassen	2,992,600	20,571	3,780	2,418	3,019,369
Modoc	2,679,819	7,774	1,627	712	2,689,932
	5,672,419	28,345	5,407	3,130	5,709,301
Mojave					
Riverside	4,105,397	195,151	159,343	212,303	4,672,194
San Bernardino	12,340,160	192,102	153,442	181,117	12,866,821
	16,445,557	387,253	312,785	393,420	17,539,015

Bioregion/ County	Wildland	Rural	Interface	Urban	Total
Sacramento Valley					
Butte	939,689	76,565	33,459	23,462	1,073,175
Colusa	729,184	6,896	2,143	1,717	739,940
Glenn	830,882	13,209	3,227	1,917	849,235
Sacramento	420,093	57,414	38,567	119,813	635,887
Shasta	2,294,910	111,626	37,955	17,610	2,462,101
Sutter	356,779	19,124	5,789	7,775	389,467
Tehama	1,811,024	64,885	15,271	3,725	1,894,905
Yolo	618,598	13,776	6,550	14,972	653,896
Yuba	350,946	49,014	6,459	5,683	412,102
	8,352,105	412,509	149,420	196,674	9,110,708
San Joaquin Valley					
Fresno	3,558,866	178,380	41,215	68,666	3,847,127
Kern	5,015,742	84,407	54,475	71,659	5,226,283
Kings	852,356	22,625	5,286	10,406	890,673
Madera	1,268,466	71,503	30,074	8,181	1,378,224
Merced	1,173,009	59,101	15,517	17,746	1,265,373
San Joaquin	739,625	97,244	27,214	47,640	911,723
Stanislaus	827,165	87,615	15,469	39,384	969,633
Tulare	2,942,268	95,025	27,467	33,660	3,098,420
	16,377,497	695,900	216,717	297,342	17,587,456
Sierra Nevada					
Alpine	470,754	1,955	969	313	473,991
Amador	335,091	32,685	17,118	2,534	387,428
Calaveras	579,082	58,785	19,818	5,328	663,013
El Dorado	730,266	147,388	49,481	18,403	945,538
Inyo	6,535,860	5,691	2,219	2,070	6,545,840
Mariposa	882,793	47,421	4,297	470	934,981
Mono	1,991,958	5,749	3,261	2,844	2,003,812
Nevada	471,470	103,210	36,238	11,915	622,833
Placer	775,031	87,077	60,147	37,700	959,955
Plumas	1,634,012	24,853	11,928	2,827	1,673,620
Sierra	610,414	3,376	1,543	322	615,655
Tuolumne	1,379,327	47,078	24,460	6,832	1,457,697
	16,396,058	565,268	231,479	91,558	17,284,363
South Coast					
Los Angeles	1,846,856	98,794	134,874	533,829	2,614,353
Orange	268,514	10,956	30,918	201,138	511,526
San Diego	2,154,122	176,067	151,920	230,047	2,712,156
	4,269,492	285,817	317,712	965,014	5,838,035

4.11.1.4 Employment

The 2013 annual average non-seasonally adjusted unemployment rate in California was 8.9 percent, down significantly from its height during the recession of 12.2 percent in 2010. However most of the rural counties are still experiencing unemployment rates higher than the state annual average, see figure 4.11-4 below.

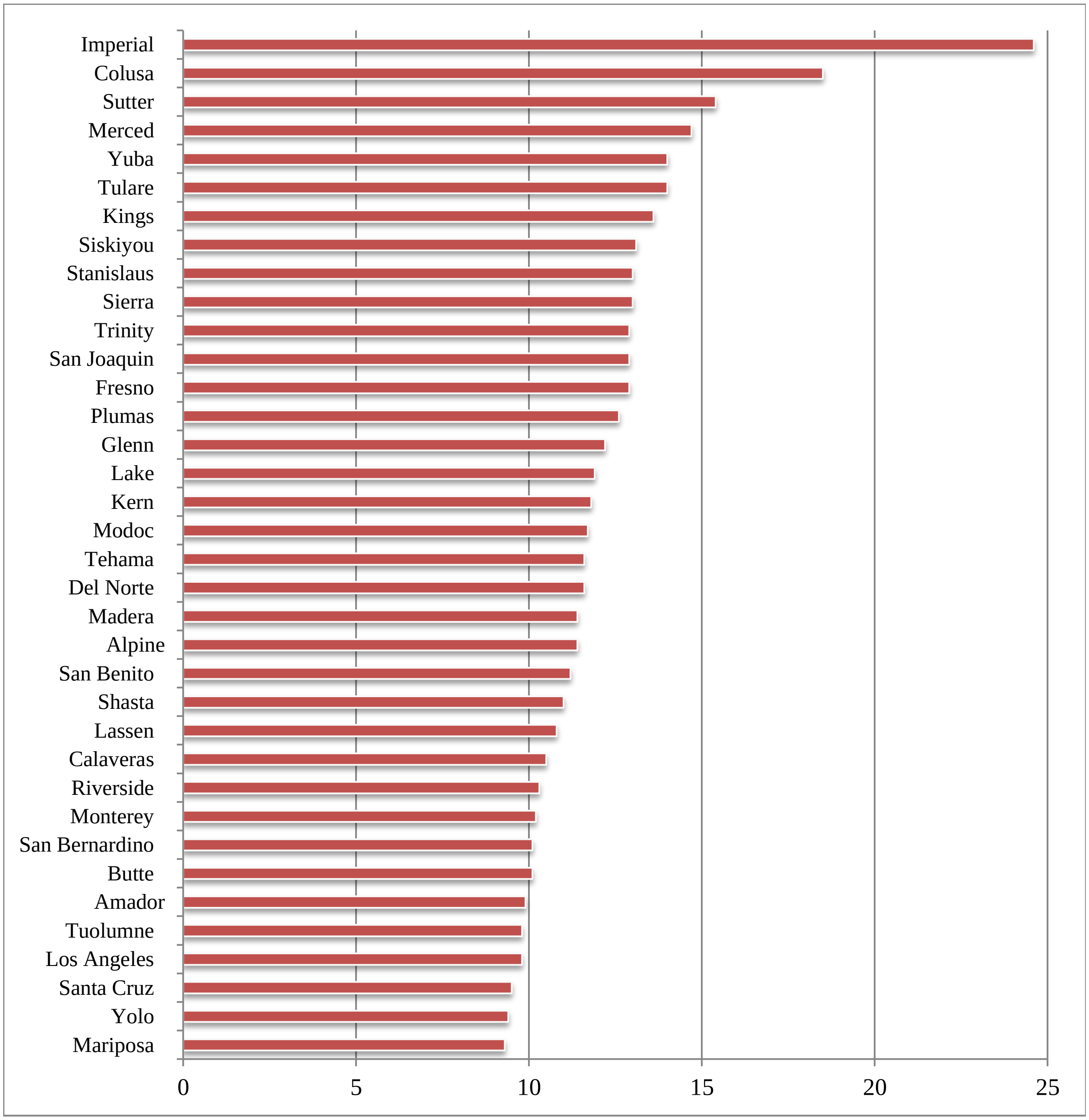


Figure 4.11-4 California Counties unemployment rates that exceed the California Annual Non-Seasonally Adjusted Unemployment Rate (BLS, 2015)

Overall wages in California have been increases in California, regardless of unemployment rates (Figure 4.11-5). Average annual wages hit $60,000 in 2013 and are expected to continue to increase as new minimum wage laws go into effect July 1, 2014 and January 1, 2016. By January 1, 2016 minimum wage in the State of California will be $10/hour.

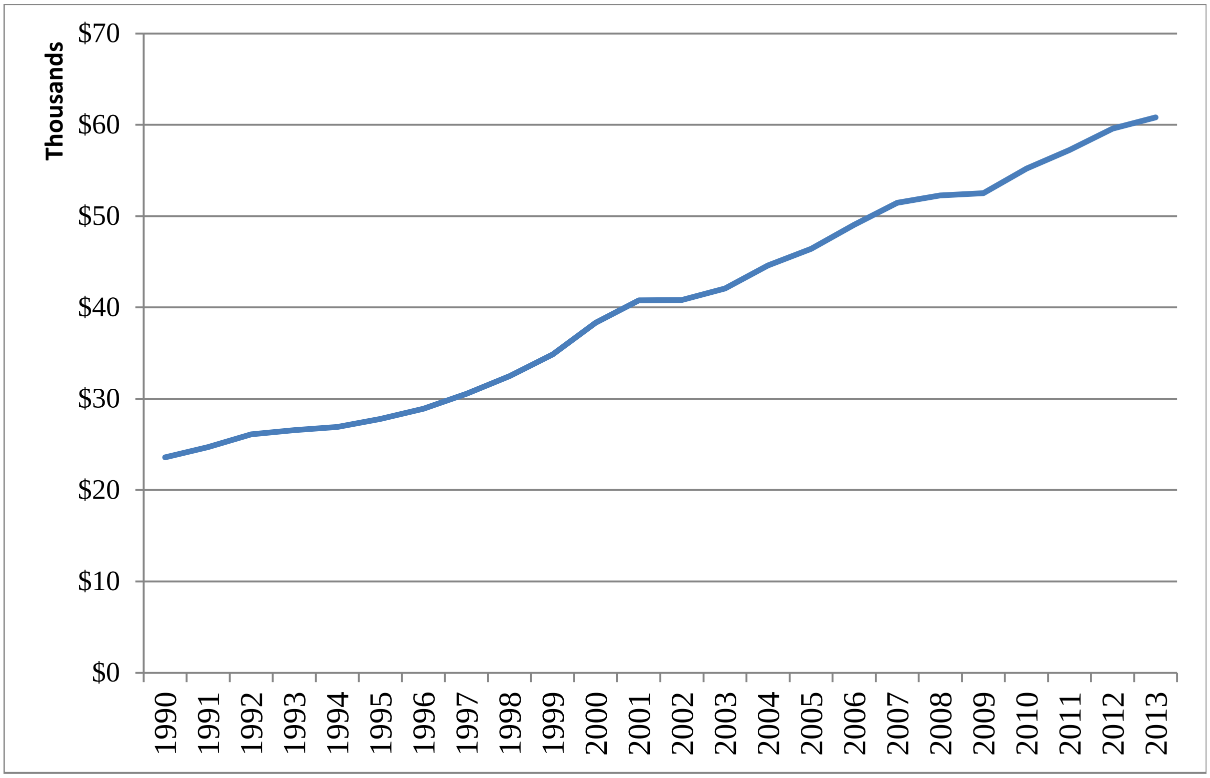


Figure 4.11-5 Average Annual Wages in the Thousands of Dollars 1990-2013 (EDD, 2014).

4.11.2 EFFECTS

4.11.2.1 Significance Criteria

Appendix G of the CEQA Guidelines, the CEQA Environmental Checklist, contains only one question which is relevant to the VTP program. The Program and Alternatives would be considered to create a significant effect if treatments:

- Induce substantial population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure).

4.11.2.2 Determination Threshold

While there is no accepted percentage population increase to be used as a threshold, population change less than a certain amount can easily be considered negligible. The impact would be considered less than significant if an increase in population less than 0.5 percent in the bioregion resulted from implementation of the program.

4.11.2.3 Data & Assumptions

Implementation of VTP projects within a bioregion will not temporarily increase the population of that region. Workers are part of crews that do not live on or near the project site and move back and forth between a project site and their established camp or base.

4.11.2.4 Impacts of Implementing the Program/Alternatives

The potential change in population resulting from implementation of the proposed program is less than significant in all bioregions, because the proposed Program does not require the long-term or permanent migration of workers into the project area. Implementation of the program will not induce sufficient population change to cause a need for new housing, roads or infrastructure. The No Project Alternative or Alternatives A-D would not induce substantial population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure) for the same reason. The impacts to population remain below the 0.5% threshold and are considered **less than significant**.

4.11.3 MITIGATION AND STANDARD PROJECT REQUIREMENTS

No mitigation measures or standard project requirements are required under this analysis for Population, Employment, Housing and Socio-Economic wellbeing.

4.12 AIR QUALITY

Vegetation treatment activities proposed by this program have the potential to generate emissions identified by the state and federal governments as pollutants of concern. This section describes existing air quality conditions, applicable federal and state regulations, and includes an analysis of potential impacts to air quality.

4.12.1 AFFECTED ENVIRONMENT

4.12.1.1 Regulatory Framework

4.12.1.1.1 FEDERAL PLANS, POLICIES, REGULATIONS, AND LAWS

CLEAN AIR ACT

The U.S. Environmental Protection Agency (EPA) implements national air quality programs at the Federal level. EPA's air quality mandates are drawn primarily from the federal Clean Air Act (CAA), which was enacted in 1970 and amended by Congress in 1990. The CAA requires EPA to establish national ambient air quality standards (NAAQS), which are presented in Table 4.12-1 below. EPA has established primary and secondary NAAQS for the following criteria air pollutants: ozone, CO, NO_2, SO_2, PM_{10}, $PM_{2.5}$, and lead, with primary standards aimed at protecting public health and secondary standards protecting public welfare. EPA maintains and publishes National Area Designation Maps that display the most current data of national attainment status throughout California. The most recent revision was completed in January 30, 2015 (EPA 2015).

The CAA also requires each state to prepare an air quality control plan referred to as a State Implementation Plan (SIP). The federal Clean Air Act Amendments of 1990 (CAAA) added requirements for states with nonattainment areas to revise their SIPs to incorporate additional control measures to reduce air pollution. The SIP is modified periodically to reflect the latest emissions inventories, planning documents, and rules and regulations of the air basins as reported by their jurisdictional agencies. EPA reviews all SIPs to determine whether they conform to the mandates of the CAA and its amendments and whether implementing them will achieve air quality goals. If EPA determines a SIP to be inadequate, a Federal Implementation Plan that imposes additional control measures may be prepared for the nonattainment area. If the state fails to submit an approvable SIP or to implement the plan within the mandated time frame, sanctions may be applied to transportation funding and stationary air pollution sources in the air basins.

Table 4.12-1 Ambient Air Quality Standards and Designations

Pollutant	Averaging Time	California Standards [1, 3]	National Standards [2] Primary [3]
Ozone	1-hour	0.09 ppm (180 $\mu g/m^3$)	–
	8-hour	0.070 ppm (137 $\mu g/m^3$)	0.075 ppm (147 $\mu g/m^3$)
Carbon Monoxide (CO)	1-hour	20 ppm (23 mg/m^3)	35 ppm (40 mg/m^3)
	8-hour	9 ppm (10 mg/m^3)	9 ppm (10 mg/m^3)
	8-hour (Lake Tahoe)	6 ppm (7 mg/m^3)	–
Nitrogen Dioxide (NO_2)[4]	Annual Arithmetic Mean	0.030 ppm (57 $\mu g/m^3$)	0.053 ppm (100 $\mu g/m^3$)
	1-hour	0.18 ppm (339 $\mu g/m^3$)	100 ppb (188 $\mu g/m^3$)
Sulfur Dioxide (SO_2)[5]	Annual Arithmetic Mean	–	0.030 ppm (for certain areas)[5]
	24-hour	0.04 ppm (105 $\mu g/m^3$)	0.14 ppm (for certain areas)[5]
	3-hour	–	0.5 ppm (1300 $\mu g/m^3$)[6]
	1-hour	0.25 ppm (655 $\mu g/m^3$)	75 ppb (80 $\mu g/m^3$)
Respirable Particulate Matter (PM_{10})[7]	Annual Arithmetic Mean	20 $\mu g/m^3$	–
	24-hour	50 $\mu g/m^3$	150 $\mu g/m^3$
Fine Particulate Matter ($PM_{2.5}$)[7]	Annual Arithmetic Mean	12 $\mu g/m^3$	12 $\mu g/m^3$
	24-hour	–	35 $\mu g/m^3$
Lead [8, 9]	30-day Average	1.5 $\mu g/m^3$	–
	Calendar Quarter	–	1.5 $\mu g/m^3$ (for certain areas)[8]
	Rolling 3-Month Avg.	–	0.15 $\mu g/m^3$
Sulfates	24-hour	25 $\mu g/m^3$	No National Standards
Hydrogen Sulfide	1-hour	0.03 ppm (42 $\mu g/m^3$)	
Vinyl Chloride[9]	24-hour	0.01 ppm (26 $\mu g/m^3$)	
Visibility-Reducing Particle Matter	8-hour	Extinction coefficient of 0.23 per kilometer —visibility of 10 mi or more	

Notes: $\mu g/m^3$ = micrograms per cubic meter; ppm = parts per million; ppb = parts per billion; CAAQS = California ambient air quality standards

[1] California standards for ozone, CO (except 8-hour Lake Tahoe), SO_2 (1- and 24-hour), NO_2, PM, and visibility-reducing particles are values that are not to be exceeded. All others are not to be equaled or exceeded. CAAQS are listed in the Table of Standards in Section 70200 of Title 17 of the California Code of Regulations.

[2] National standards (other than ozone, PM, and those based on annual arithmetic mean) are not to be exceeded more than once a year. The ozone standard is attained when the fourth highest 8-hour concentration measured at each site in a year, averaged over 3 years, is equal or less than the standard. For PM_{10}, the 24-hour standard is attained when the expected number of days per calendar year with a 24-hour average concentration above 150 $\mu g/m^3$ is equal to or less than one. For $PM_{2.5}$, the 24 hour standard is attained when 98 percent of the daily concentrations, averaged over three years, are equal to or less than the standard. Contact the U.S. EPA for further clarification and current national policies.

[3] Concentration expressed first in units in which it was promulgated [i.e., parts per million (ppm) or micrograms per cubic meter ($\mu g/m^3$)]. Equivalent units given in parentheses are based upon a reference temperature of 25°C and a reference pressure of 760 torr. Most measurements of air quality are to be corrected to a reference temperature of 25°C and a reference pressure of 760 torr; ppm in this table refers to ppm by volume, or micromoles of pollutant per mole of gas.

4 To attain the 1-hour national standard, the 3-year average of the annual 98th percentile of the 1-hour daily maximum concentrations at each site must not exceed 100 ppb. Note that the national 1-hour standard is in units of ppb. California standards are in ppm. To directly compare the national 1-hour standard to the California standards the units can be converted from ppb to ppm.

5 On June 2, 2010, a new 1-hour SO_2 standard was established and the existing 24-hour and annual primary standards were revoked. To attain the 1-hour national standard, the 3-year average of the annual 99th percentile of the 1-hour daily maximum concentrations at each site must not exceed 75 ppb. The 1971 SO_2 national standards (24-hour and annual) remain in effect until one year after an area is designated for the 2010 standard, except that in areas designated nonattainment for the 1971 standards, the 1971 standards remain in effect until implementation plans to attain or maintain the 2010 standards are approved. Note that the national 1-hour standard is in units of ppb. California standards are in ppm. To directly compare the national 1-hour standard to the California standards the units can be converted from ppb to ppm.

6 Secondary Standard.

7 On December 14, 2012, the national annual $PM_{2.5}$ primary standard was lowered from 15 $\mu g/m^3$ to 12.0 $\mu g/m^3$. The existing national 24-hour $PM_{2.5}$ standards (primary and secondary) were retained at 35 $\mu g/m^3$, as was he annual secondary standard of 15 $\mu g/m^3$. The existing 24-hour PM_{10} standards (primary and secondary) of 150 $\mu g/m^3$ also were retained. The form of the annual primary and secondary standards is the annual mean, averaged over 3 years.

8 The national standard for lead was revised on October 15, 2008 to a rolling 3-month average. The 1978 lead standard (1.5 $\mu g/m^3$ as a quarterly average) remains in effect until one year after an area is designated for the 2008 standard, except that in areas designated nonattainment for the 1978 standard, the 1978 standard remains in effect until implementation plans to attain or maintain the 2008 standard are approved.

9 ARB has identified lead and vinyl chloride as toxic air contaminants with no threshold level of exposure for adverse health effects determined. These actions allow for the implementation of control measures at levels below the ambient concentrations specified for these pollutants.

Source: ARB 2013c.

CLEAN AIR ACT AMMENDMENTS OF 1990 (CAAA)

The CAAA revised the CAA to address curb three major threats that had not previously been addressed: acid rain, urban air pollution, and toxic air emissions. Title III of the CAAA directed EPA to issue national emissions standards for hazardous air pollutants (HAPs), which may be different for major sources than for area sources of HAPs. Major sources are defined as stationary sources with potential to emit more than 10 tons per year (TPY) of any HAP or more than 25 TPY of any combination of HAPs; all other sources are considered area sources. The EPA has programs for identifying and regulating HAPs.

The CAAA also requires the EPA to issue vehicle or fuel standards containing reasonable requirements for exhaust emissions of TACs. Performance criteria were established to limit mobile-source emissions of toxics, including benzene, formaldehyde, and 1, 3-butadiene.

AP 42. COMPILATION OF AIR POLLUTANT EMISSION FACTORS

Since 1972, the EPA has been publishing *AP-42 Compilation of Air Pollutant Emission Factors*, as the primary compilation of EPA's emissions factor information. It contains emission factors of process information for more than 200 air pollution source categories. The emission factors have been developed and compiled from source test data, material balance studies and engineering estimates. The Fifth Edition of AP-42 was published in January 1995 and since that time the EPA has published a number of supplements and updates. Chapter 13.1 of AP42's Fifth Edition sets forth guidelines for computing air quality emissions for prescribed fire. Regarding wildfire and prescribed burning, the EPA acknowledges that there is a significant difference between emissions, primarily due to less "available fuel" (combustible material that will be consumed by fire under specific climatic conditions) during prescribed burning.

FEDERAL ADVISORY COMMITTEE ACT (FACA) – OZONE, PM, REGION HAZE IMPLEMENATION: WILDLAND FIRE ISSUES GROUP

Established through a charter, the purpose of the FACA Wildland Fire Issues Group was to provide the EPA with recommendations for revising its policies for implementing the current PM-10 standard and any new fine PM NAAQS, with respect to prescribed fire and its impact. Although the charter for the FACA for Ozone, Particulate Matter, and Regional Haze has expired, the findings of the Wildland Fire Issues Group still pertain to prescribed fire in relation to Air Quality. Most importantly the *Interim Air Quality Policy on Wildland and Prescribed Fires* was produced by the group is the national standard when local guidelines have not been established. The document outlines Smoke Management Programs (SMPs), who is accountable when prescribed fire exceeds the federal air quality thresholds, and overall objectives for prescribed fire in relation to air quality.

PRESCRIBED FIRE SMOKE MANAGEMENT GUIDE

In 2001 the National Wildfire Coordinating Group's (NWCG) Fire Use Working Team sponsored the creation of the *Smoke Management Guide for Prescribed and Wildland Fire*. The guide outlines why fire is important to the ecosystem, regulations that impact smoke management, best management practices for reducing emissions in prescribed fire, and ways to monitor air quality during prescribed fires. The EPA advises consulting this guide when calculating emissions for prescribed fire.

4.12.1.1.2 STATE PLANS, POLICIES, REGULATIONS, AND LAWS

CALIFORNIA AIR RESOURCES BOARD (ARB)

The California Air Resources Board (ARB) was created in 1967 when the California Motor Vehicle Pollution Control Board and the Bureau of Air Sanitation and its Laboratory where merged together by Governor Ronald Regan through the Mulford Air Resource Act. ARB oversees local air district compliance with federal and state laws, approving local air quality plans, submitting SIPs to EPA, monitoring air quality, determining and updating area designations and maps, and setting emissions standards for new mobile sources, consumer products, small utility engines, off-road vehicles, and fuels. ARB is also responsible for specifying each day of the year as a permissive burn day, marginal burn day, or a no-burn day for each air basin or other specified area. These decisions determine when agricultural and prescribed wildland burning may occur based on weather and air quality conditions (ARB 2011). For permission to burn, however, individuals are required to receive daily approval from their local air quality management district, which has information on local conditions, including fire danger.

ARB has authority to approve local smoke management programs. Elements of these programs include permitting requirements for agricultural and prescribed burns, meteorological and smoke management forecasting, and a daily burn authorization system (ARB 2000).

Wildfires that contribute to exceedances of air quality standards may be considered exceptional events by the ARB. Impacts to air quality from these events may last days, weeks, or even months after ignition and are beyond regulatory control. ARB reports a total of 288 wildfires greater than 300 acres in size that may have contributed to higher than normal particulate matter concentrations from 2007 through 2013, with an average of 41 events per year during this time period (ARB, 2015). The *California Wildfire Smoke Response Coordination*, prepared under the auspices of ARB's California Air Response Planning Agency (CARPA) and the California Interagency and Smoke Council, provides useful information and resources seeking assistance in protecting the public's health from the impacts of smoke during catastrophic fires (CARPA 2008).

CALIFORNIA CLEAN AIR ACT (CCAA)

ARB coordinates and oversees state and local programs for controlling air pollution in California and implements the CCAA, which was adopted in 1988. The CCAA requires ARB to establish California ambient air quality standards (CAAQS), which are presented above in Table 4.12-1. In addition to establishing CAAQS for ozone, CO, NO_2, SO_2, PM_{10}, $PM_{2.5}$, and lead, ARB has established CAAQS for sulfates, hydrogen sulfide, vinyl chloride, visibility-reducing particulate matter as well. In most cases, the CAAQS are more stringent than the NAAQS. Differences in the standards are generally explained by the health effects studies considered during the standard-setting process and the interpretation of the studies. In addition, the CAAQS incorporate a margin of safety to protect sensitive individuals.

TANNER AIR TOXICS ACT AND THE AIR TOXICS HOT SPOTS INFORMATION AND ASSESSMENT ACT

TACs in California are regulated primarily through the Tanner Air Toxics Act (Assembly Bill [AB] 1807, Chapter 1047, Statutes of 1983) and the Air Toxics Hot Spots Information and Assessment Act of 1987 (AB 2588, Chapter 1252, Statutes of 1987). AB 1807 sets forth a formal procedure for ARB to designate substances as TACs. Research, public participation, and scientific peer review are required before ARB can designate a substance as a TAC. To date, ARB has identified more than 21 TACs and adopted U.S. EPA's list of HAPs as TACs. Most recently, PM exhaust from diesel engines (diesel PM) was added to ARB's list of TACs.

Once a TAC is identified, ARB then adopts an airborne toxics control measure for sources that emit that particular TAC. If a safe threshold exists for a substance at which there is no toxic effect, the control measure must reduce exposure below that threshold. If no safe threshold exists, the measure must incorporate best available control technology for toxics to minimize emissions.

The Hot Spots Act requires that existing facilities that emit toxic substances above a specified level prepare an inventory of toxic emissions, prepare a risk assessment if emissions are significant, notify the public of significant risk levels, and prepare and implement risk reduction measures.

ARB has adopted diesel exhaust control measures and more stringent emissions standards for various transportation-related mobile sources of emissions, including transit buses, and off-road diesel equipment (e.g., tractors, generators). Over time, the replacement of older vehicles will result in a vehicle fleet that produces substantially lower levels of TACs than under current conditions. Mobile-source emissions of TACs (e.g., benzene, 1-3-butadiene, diesel PM) have been reduced significantly over the last decade and will be reduced further in California through a progression of regulatory measures (e.g., Low Emission Vehicle/Clean Fuels and Phase II reformulated gasoline regulations) and control technologies. With implementation of ARB's Risk Reduction Plan, it is expected that diesel PM concentrations will be 85 percent less in 2020 in comparison to year 2000. Adopted regulations are also expected to continue to reduce formaldehyde emissions from cars and light-duty trucks. As emissions are reduced, it is expected that risks associated with exposure to the emissions will also be reduced.

CALIFORNIA CODE OF REGULATIONS TITLE 17

Title 17 of the California Code of Regulations (CCR) addresses public health issues. Division 3 of Title 17 specifically addresses issues related to air resources. Topics most relevant to projects conducted under the VTP include: Air Basins and Air Quality Standards (Subchapter 1.5), Smoke Management Guidelines for Agricultural and

Prescribed Burning (Subchapter 2), Toxic Air Contaminants (Subchapter 7), and Climate Change (Subchapter 10).

The ARB oversees California's Smoke Management Program, which addresses potentially harmful smoke impacts from agricultural, forest, and range land management burning operations. The legal basis of the program is found in *17 CCR § 80100 et. seq., Smoke Management Guidelines for Agricultural and Prescribed Burning,* adopted by ARB on March 23, 2000 (ARB 2011). Under these guidelines, air districts implement a daily burn authorization system under which they specify the amount, timing, and location of burns for the purpose of minimizing smoke impacts on sensitive areas, avoid cumulative smoke impacts, and prevent public nuisance from occurring. Through the burn authorization system, the air district authorizes no more burning on a daily basis than is appropriate considering meteorological and air quality conditions (ARB, 2000).

Adoption of the amendments to the Smoke Management Guidelines for Agricultural and Prescribed Burning by the ARB on March 23, 2000 triggered a CEQA analysis. The ARB concluded that adoption of these guidelines would not cause significant adverse environmental impacts. They further concluded, in regard to air quality impacts, that compliance with the guidelines should result in reduced smoke impacts, improved air quality, and progress towards achievement of CAA and CCAA requirements, and go on to speculate that potential benefits from the program may accrue from a reduction in risk of catastrophic wildland fires from increased prescribed burning activities (ARB, 2000).

CALIFORNIA AIR BASINS

California is divided geographically in 15 separate air basins for the purpose of managing air resources for the State of California on a regional basis. Air basins generally have meteorological and geographical similarities allowing for a more customized approach for each region’s air quality decision making. Air pollution can generally move freely within each air basin, and in some cases can move between adjacent air basins.

Figure 4.12.1.1.2-1 California Air Basins (ARB, 2014)

CALIFORNIA'S SMOKE MANAGEMENT PROGRAM

As discussed earlier, the ARB oversees California's Smoke Management Program. California established a statewide Smoke Management Program in March of 2000, which was approved by the EPA in August of 2003. California's Smoke Management Program meets the 7 program elements described in the *Interim Air Quality Policy on Wildland and Prescribed Fires.* Four of the seven elements include:

- Registering and permitting of agricultural and prescribed burns,
- Meteorological and smoke management forecasting,
- Daily burn authorization,

- And enforcement.

This Smoke Management Program is implemented by the local air districts and is discussed in greater detail below.

4.12.1.1.3 LOCAL PLANS, POLICIES, REGULATIONS, AND LAWS

CALIFORNIA AIR DISTRICTS

There are 35 air pollution control districts or air quality management districts (air districts) across California. The CCAA requires that all local air districts in the state work towards achieving and maintaining the CAAQS by the earliest practical date. The act specifies that local air districts should focus particular attention on reducing the emissions from transportation and area wide emission sources, and provides districts with the authority to regulate indirect sources.

Air districts attain and maintain air quality conditions in their respective jurisdictions through a comprehensive program of planning, regulation, enforcement, technical innovation, and promotion of the understanding of air quality issues. The clean air strategy implemented by air districts includes the preparation of plans for the attainment of CAAQS and NAAQS, adoption and enforcement of rules and regulations concerning sources of air pollution, and issuance of permits for stationary sources of air pollution. Air districts also inspect stationary sources of air pollution and respond to citizen complaints, monitor ambient air quality and meteorological conditions, and implement programs and regulations required by the CAA, CAAA, and the CCAA.

The CCAA requires all local air quality management districts and air pollution control districts (air districts) in the state to achieve and maintain the CAAQS by the earliest practical date. The CCAA specifies that local air districts should focus particular attention on reducing the emissions from transportation and area wide emission sources. Area wide sources have emissions spread out over wide areas. Prescribed burning is categorized by the ARB as an area wide source under the miscellaneous processes category (ARB, 2009) and is managed through the local districts burn authorization system. The CCAA provides districts with the authority to regulate indirect sources.

Each air quality district maintains its own specific regulations regarding open burning. Open burning regulations encompass both agricultural burning and prescribed wildland burning. The air quality district controls emissions by regulating the amount, timing and location of burn events to minimize air quality impacts from smoke. All open burning is restricted to burn days, marginal burn days, or through variances permitted by the local district. The ARB and local districts use information on existing air quality conditions and meteorological predictions to determine whether to allow burning, and if so, the volume and locations of burning it will allow on any given day. Each air district, fire control agency, or burning permit agency has the authority to be more restrictive than ARB to avoid air quality impacts. Land managers conducting prescribed burns must register yearly or seasonally with the local district and, when applicable, submit a smoke management plan (SMP) for approval prior to burning. Projects requiring a SMP, even on otherwise permissive burn days, require the land manager or his/her designee conducting the prescribed burn to ensure that all conditions and requirements agreed to in the approved smoke management plan are met on the day of the burn event prior to ignition [17 CCR §80160(j)].

Figure 4.12.1.1.3- California Air Quality Management Districts and Air Pollution Management Districts

SMOKE MANAGEMENT PLANS

Under the California Smoke Management Program each local district is required to regulate prescribed burning through adoption of a Smoke Management Program within their respective district that adheres to the overall objectives and goals of the California

Smoke Management Program. Each local district requires a Smoke Management Plan (SMP) be submitted by land managers conducting prescribed burning that meets certain specifications. A SMP is required for any prescribed fire activity under this VTP (SPR AIR-12). An example SMP is located in Appendix J.

All prescribed burning must comply with the local districts burn authorization system, and larger projects are subject to tiered requirements for submission and approval of SMPs. Burn projects over 10 acres in size or estimated to produce more than one ton of particulate matter are required to include the location, types, and amounts of material to be burned, expected duration of the fire, identification of responsible personnel, and identification of all smoke sensitive areas in the SMP. Burn projects greater than 100 acres or estimated to produce more than 10 tons of particulate matter require additional information in the SMP, including meteorological conditions necessary for burning, projections of where the smoke is expected to travel (both day and night), and contingency actions to be taken if smoke impacts occur or meteorological conditions deviate from those specified in the SMP. Projects greater than 250 acres or near smoke sensitive areas must also include a monitoring component to the SMP (17 CCR §80160).

It is through this real time, site specific burn authorization system and associated SMP that prescribed burning is treated differently from other potential treatment alternatives proposed by the VTP. The local air district becomes the ultimate arbiter in whether the project can occur as proposed, in a limited capacity, or must be postponed based on the predicted transport and placement of pollutants from the project relative to sensitive receptors that may be impacted by the project. Prescribed fire projects need not only an authorization from the local air district, but also must ensure that the conditions set forth in the approved SMP are met prior to ignition of a prescribed fire. That is, even with authorization from the local district to conduct the prescribed burn, if the conditions and requirements of the SMP are not met on site, ignition is prohibited [17 CCR §80160(j)].

4.12.1.2 Environmental Setting

4.12.1.2.1 Topography, Meteorology, Climate

California has a wide range of geophysical features including mountains, valleys, oceans, and deserts. The Pacific Ocean forms the state's western boundary, stretching more than 1,200 miles. The Central Valley is located in the middle of the state and surrounded by various mountain ranges. Multiple coastal mountain ranges lie to the west of the Central Valley; the Sierra Nevada to the east, the Cascade Range to the north, and the Tehachapi Mountains to the south. California also has expansive deserts, such as the Mojave Desert located in southern California, and vast forests of redwood and Douglas fir located in the northwest portion of the state (ARB 2013d). Major rivers include the Sacramento, San Joaquin, and Colorado. Major Lakes include Lake Tahoe, Salton Sea, and Owens Lake. Elevation varies greatly in California from Mount Whitney at 14,494 (highest mountain in the contiguous 48 states) to 282 feet below sea level at Death Valley (lowest elevation in the United States).

The landform features of the state affect the direction of air flow and, thus, directly affect the distribution and transportation of air pollutants. For example, air above low-lying land that is surrounded by mountains is often more atmospherically stable, which can result in it collecting more air pollutants.

California has a Mediterranean climate characterized by hot, dry summers and cool, more rainy winters, with some portions of the state experiencing more extreme temperature differences than others. Coastal portions of the state often experience summer fog as a result of the cool marine currents from the Pacific Ocean, and more moderate temperatures, whereas inland portions of the state, such as the high desert, southern San Joaquin Valley, or northern Sacramento Valley experience more extreme temperature differences. Precipitation in California generally occurs in the winter months and typically the northern regions of the state experience more average annual rainfall than the southern portions of the state (NSTATE 2014).

4.12.1.2.2 Existing Air Quality

CRITERIA AIR POLLUTANTS

Ozone, carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), respirable particulate matter (PM_{10}), fine particulate matter ($PM_{2.5}$), and lead concentrations are used to indicate the quality of the ambient air. Because extensive documentation on health-effects criteria is available for these air pollutants, they are commonly referred to as “criteria air pollutants” (CAPs). CAPs are also the most prevalent indicators of how air pollution is detrimental to human health. Brief descriptions of each CAP by emission source types and health effect is provided below in Table 4.12-2.

Table 4.12-2 Sources and Health Effects of Criteria Air Pollutants

Pollutant	Sources	Acute[1] Health Effects	Chronic[2] Health Effects
Ozone	Secondary pollutant resulting from reaction of ROG, a subset of VOC, and NO_X in presence of sunlight. ROG emissions result from incomplete combustion and evaporation of chemical solvents and fuels; NO_X results from the combustion of fuels	Increased respiration and pulmonary resistance; cough, pain, shortness of breath, lung inflammation	Permeability of respiratory epithelia, possibility of permanent lung impairment
Carbon monoxide (CO)	Incomplete combustion of fuels; motor vehicle exhaust	Headache, dizziness, fatigue, nausea, vomiting, death	Permanent heart and brain damage
Nitrogen dioxide (NO_2)	Combustion devices; e.g., boilers, gas turbines, and mobile and stationary reciprocating internal combustion engines	Coughing, difficulty breathing, vomiting, headache, eye irritation, chemical pneumonitis or pulmonary edema; breathing abnormalities, cough, cyanosis, chest pain, rapid heartbeat, death	Chronic bronchitis, decreased lung function
Sulfur dioxide (SO_2)	Coal and oil combustion, steel mills, refineries, and pulp and paper mills	Irritation of upper respiratory tract, increased asthma symptoms	Insufficient evidence linking SO_2 exposure to chronic health impacts
Respirable particulate matter (PM_{10}) and fine particulate matter ($PM_{2.5}$)	Fugitive dust, soot, smoke, mobile and stationary sources, construction, fires and natural windblown dust, and formation in the atmosphere by condensation and/or transformation of SO_2 and ROG	Breathing and respiratory symptoms, aggravation of existing respiratory and cardiovascular diseases, premature death	Alterations to the immune system, carcinogenesis
Lead	Metal processing	Reproductive/ developmental effects (fetuses and children)	Numerous effects including neurological, endocrine, and cardiovascular effects

Notes: NO_X = oxides of nitrogen; VOC= Volatile Organic Compounds; ROG = reactive organic gases.
[1] “Acute” refers to effects of short-term exposures to criteria air pollutants, usually at relatively high concentrations.
[2] “Chronic” refers to effects of long-term exposures to criteria air pollutants, even at relatively low concentrations.
Source: EPA 2014.

OZONE

Ozone is a photochemical oxidant (a substance whose oxygen combines chemically with another substance in the presence of sunlight) and the primary component of smog. Most ground-level ozone is not directly emitted into the air but is formed through complex chemical reactions between precursor emissions of reactive organic gases (ROG) and oxides of nitrogen (NO_X) in the presence of sunlight. ROG is a subset of volatile organic compounds (VOC) and its emissions result primarily from incomplete combustion and the evaporation of chemical solvents used primarily in coating and adhesive processes, as well as evaporation of fuels. ROG is also continually released biogenically in large quantities from plant and trees. NO_X are a group of gaseous compounds of nitrogen and oxygen that result from the combustion of fuels. Ozone has also been known to cause significant damage to crops, forestland, and other ecosystems.

According to the California Air Resources Board's (ARB's) *2013 California Almanac of Emissions and Air Quality*, which provides state-wide air quality trends, emissions of ozone precursors ROG and NO_X have decreased over the past several years because of more stringent motor vehicle standards and cleaner burning fuels. Compared with 1990, ozone concentrations are about 10 to 50 percent lower throughout California, with some of the largest decreases occurring in areas with the worst ozone air qualities (ARB 2013d: p. 1-5). However, most counties in California are in nonattainment for ozone. Refer to Table 4.12-3 below for details regarding the attainment status of ozone throughout California.

Table 4.12-3 Summary of California Air Quality Standards Attainment Status by County

County	Ozone	Respirable Particulate Matter (PM_{10})	Fine Particulate Matter ($PM_{2.5}$)
Alameda	N	N	N
Alpine	U	N	A
Amador	N	U	U
Butte	N	N	N
Calaveras	N	N	U
Colusa	A	N	A
Contra Costa	N	N	N
Del Norte	A	A	A
El Dorado	N	N	N_P
Fresno	N	N	N
Glenn	A	N	A
Humboldt	A	N	A
Imperial	N	N	A
Inyo	N	N	A
Kern	N	N	N_P
Kings	N	N	N
Lake	A	A	A
Lassen	A	N	A
Los Angeles	N	N	N_P
Madera	N	N	N
Marin	N	N	N
Mariposa	N	U	U
Mendocino	A	N	A
Merced	N	N	N
Modoc	A	N	A
Mono	N	N	A
Monterey	N	N	A
Napa	N	N	N
Nevada	N	N	U
Orange	N	N	N
Placer	N	N	N_P
Plumas	U	N	N_P
Riverside	N	N	N_P
Sacramento	N	N	A
San Benito	N	N	A
San Bernardino	N	N	N_P
San Diego	N	N	N
San Francisco	N	N	N
San Joaquin	N	N	N
San Luis Obispo	N	N	A
San Mateo	N	N	N
Santa Barbara	N	N	U
Santa Clara	N	N	N
Santa Cruz	N	N	A
Shasta	N	N	A
Sierra	U	N	U
Siskiyou	A	A	A
Solano	N	N	U
Sonoma	N_P	N_P	N_P
Stanislaus	N	N	N
Sutter	N_T	N	A
Tehama	N	N	U
Trinity	A	A	A
Tulare	N	N	N
Tuolumne	N	U	U
Ventura	NX	N	A
Yolo	N	N	U
Yuba	N_T	N	A

Notes:

N = Nonattainment; NT = Nonattainment-Transitional (i.e., A subcategory of the nonattainment designation that signals progress and implies the area is nearing attainment.); NP = Some portion of the county is classified as Nonattainment; A = Attainment; U = Unclassified (i.e., Any area that cannot be classified on the basis of available information as meeting or not meeting the California ambient air quality standards (CAAQS))

All counties in California are designated as unclassified or in attainment with the CAAQS for CO and visibility reducing particles. All counties in California are designated as in attainment with the CAAQS for NO2, SO2, sulfates, and lead. All counties in California are designated as unclassified or in attainment for hydrogen sulfide, except for portions of San Bernardino County which is in nonattainment. Source: ARB 2013b

NITROGEN DIOXIDE

Nitrogen dioxide (NO_2) is a brownish, highly reactive gas. The major human-made sources of NO_2 are combustion devices, such as boilers, gas turbines, and mobile and stationary reciprocating internal combustion engines. Combustion devices emit primarily nitric oxide (NO), which reacts through oxidation in the atmosphere to form NO_2. The combined emissions of NO and NO_2 are referred to as NO_x and are reported as equivalent NO_2. NO_2 forms quickly from emissions from cars, trucks and buses, power plants, and off-road equipment. Because NO_2 is formed and depleted by reactions associated with photochemical smog (ozone), the NO_2 concentration in a particular geographical area may not be representative of the local sources of NO_X emissions (EPA 2014a and ARB 2013d: p.1-22).

PARTICULATE MATTER

Respirable particulate matter with an aerodynamic diameter of 10 micrometers or less is referred to as PM_{10}. PM_{10} consists of particulate matter emitted directly into the air, such as fugitive dust, soot, and smoke from mobile and stationary sources, construction equipment, fires and natural windblown dust, and particulate matter formed in the atmosphere by reaction of gaseous precursors. Fine particulate matter ($PM_{2.5}$) includes a subgroup of smaller particles that have an aerodynamic diameter of 2.5 micrometers or less. Area-wide sources account for about 65 and 83 percent of the statewide emissions of directly emitted $PM_{2.5}$ and PM_{10}, respectively. The major area-wide sources of $PM_{2.5}$ and PM_{10} are fugitive dust, especially dust from unpaved and paved roads, agricultural operations, and construction and demolition. PM is the principal pollutant of concern from smoke from fire in the short-term (ARB 2008: p. 4). Sources of PM_{10} include crushing or grinding operations, and dust stirred up by vehicles traveling on roads. Sources of $PM_{2.5}$ include all types of combustion, including motor vehicles, power plants, residential wood burning, forest fires, agricultural burning, and some industrial processes. Due to an overall reduction in area-wide source emissions, PM_{10} emissions are projected to decrease through 2035. $PM_{2.5}$ are also projected to decrease through 2035 as a result of reduced stationary source and area-wide source emissions. Emissions of $PM_{2.5}$ are dominated by the same sources as emissions of PM_{10} (ARB 2013d: p. 2-4).

EMISSIONS INVENTORY

Figure 4.13-1 summarizes emissions of CAPs within California for various source categories in 2013. According to California's emissions inventory, mobile sources are the largest contributor to the estimated annual average for air pollutant levels of VOC, which contains ROG, and NO_x, accounting for approximately 43 percent and 83 percent respectively, of the total emissions. Area wide sources account for approximately 83 percent and 65 percent of California's PM_{10} and $PM_{2.5}$ emissions, respectively (ARB 2013c).

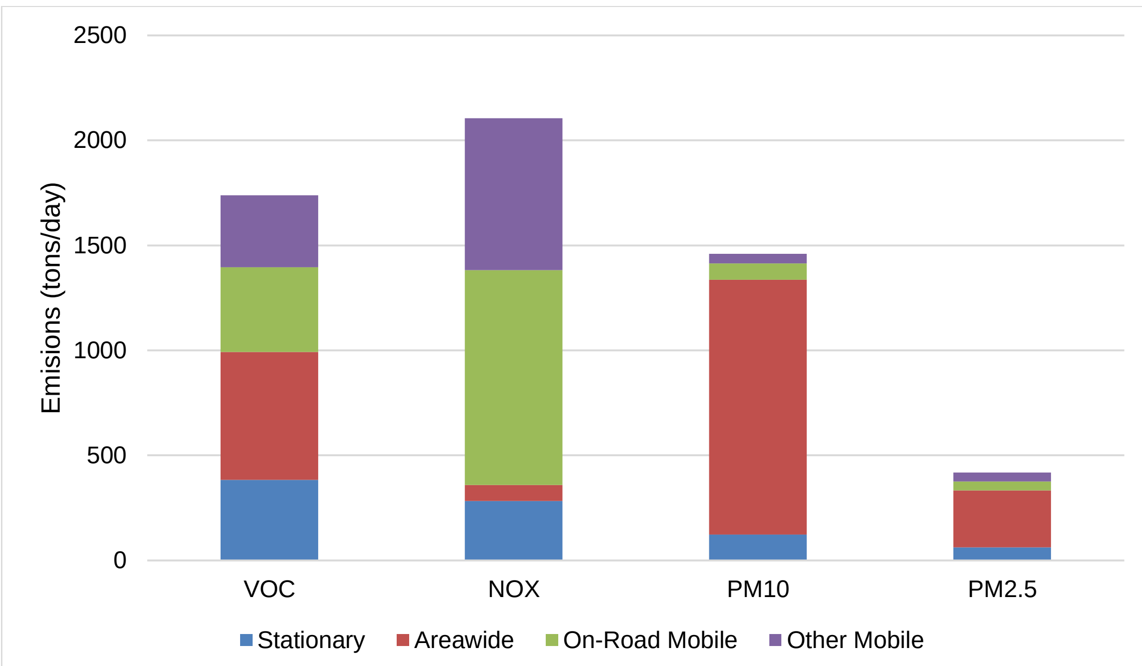


Figure 4.12-1 California 2012 Emissions Inventory

Source: ARB 2013c

4.12.1.2.3 Toxic Air Contaminants

Concentrations of toxic air contaminants (TACs) are also used to indicate the quality of ambient air. A TAC is defined as an air pollutant that may cause or contribute to an increase in mortality or in serious illness, or that may pose a hazard to human health. TACs are usually present in minute quantities in the ambient air; however, their high toxicity or health risk may pose a threat to public health even at low concentrations.

According to ARB's *2013 California Almanac of Emissions and Air Quality*, the majority of the estimated health risks from TACs can be attributed to relatively few compounds, the most predominant being particulate-exhaust emissions from diesel-fueled engines (diesel PM). Diesel PM differs from other TACs in that it is not a single substance, but rather a complex mixture of hundreds of substances. Although diesel PM is emitted by diesel-fueled internal combustion engines, the composition of the emissions varies depending on engine type, operating conditions, fuel composition, lubricating oil, and whether an emissions control system is being used. Unlike some TACs, no ambient monitoring data are available for diesel PM, because no routine measurement method exists. However, ARB has made preliminary concentration estimates based on a PM exposure method. This method uses the ARB emissions inventory's PM_{10} database, ambient PM_{10} monitoring data, and the results from several studies to estimate concentrations of diesel PM. In addition to diesel PM, the TACs for which data are available that pose the greatest existing ambient risk in California are benzene, 1, 3-butadiene, acetaldehyde, carbon tetrachloride, hexavalent chromium, para-dichlorobenzene, formaldehyde, methylene chloride, and perchloroethylene.

Diesel PM poses the greatest health risk among these 10 TACs mentioned. Since 1990, the health risk associated with diesel PM has been in California has reduced by 52 percent. Overall, levels of most TACs, except para-dichlorobenzene and formaldehyde, have decreased since 1990 (ARB 2009: Chapter 5).

4.12.1.2.4 Odors

Odors are generally regarded as an annoyance rather than a health hazard. However, manifestations of a person's reaction to foul odors can range from psychological (e.g., irritation, anger, or anxiety) to physiological (e.g., circulatory and respiratory effects, nausea, vomiting, and headache).

The human nose is the sole sensing device for odors. The ability to detect odors varies considerably among people and human response to odors is subjective. Some individuals have the ability to smell very minute quantities of specific substances; others may not have the same sensitivity but may have sensitivities to odors of other substances. In addition, people may have different reactions to the same odor; an odor that is offensive to one person may be perfectly acceptable to another (e.g., fast food restaurant). It is important to also note that an unfamiliar odor is more easily detected and is more likely to cause complaints than a familiar one. This is because of the phenomenon known as odor fatigue, in which a person can become desensitized to almost any odor with repeated exposure and recognition only occurs with an alteration in the intensity.

Quality and intensity are two properties present in any odor. The quality of an odor indicates the nature of the smell experience. For instance, if a person describes an odor as flowery or sweet, then the person is describing the quality of the odor. Intensity refers to the strength of the odor. For example, a person may use the word strong to describe the intensity of an odor. Odor intensity depends on the odorant concentration in the air. When an odorous sample is progressively diluted, the odorant concentration decreases. As this occurs, the odor intensity weakens and eventually becomes so low that the detection or recognition of the odor is quite difficult. At some point during dilution, the concentration of the odorant reaches a detection threshold. An odorant concentration below the detection threshold means that the concentration in the air is not detectable by the average human.

4.12.1.2.5 Naturally Occurring Asbestos

Naturally occurring asbestos (NOA) was identified as a TAC in 1986 by ARB. NOA is located in many parts of California, and is commonly associated with ultramafic rocks (i.e., dark-colored igneous rocks that are typically rich in minerals containing magnesium and iron ["mafic" minerals] and lesser amounts of silica, such as serpentinite), according to a special publication published by the California Geological Survey (Churchill and Hill 2000). Asbestos is the common name for a group of naturally occurring fibrous silicate minerals that can separate into thin but strong and durable fibers. Ultramafic rocks form in high-temperature environments well below the surface of the earth. By the time they are exposed at the surface by geologic uplift and erosion, ultramafic rocks may be partially to completely alter into a type of metamorphic rock called serpentinite. Sometimes the metamorphic conditions are right for the formation of chrysotile asbestos or tremolite-actinolite asbestos in the bodies of these rocks, along their boundaries, or in the soil.

NOA can be released from serpentinite or other ultramafic rocks, if the rock is broken or crushed. Natural weathering and erosion processes act on asbestos-bearing rock and soil, increasing the likelihood for asbestos fibers to become airborne if disturbed. Asbestos could also be released into the air by human activities, such as construction and vehicular traffic on unpaved roads on which asbestos-bearing rock has been used as gravel. At the point of release, asbestos fibers could become airborne, causing air quality and human health hazards (USFS 2008: p. 2; ATSDR 2010).

4.12.1.2.6 Wildfire versus Prescribed Fire Emissions

There are important differences between wildfire and prescribed fire in relation to the emissions that are produced. As discussed by the EPA in the AP 42, emissions from both wildfire and prescribed fire are driven by the kinds of vegetation consumed, the moisture content of the vegetation, meteorological conditions, and weight of consumable fuel per acre (fuel load). The significance of both fuel type and fuel load cannot be overstated (EPA 1995). The primary difference between wildfire and prescribed fire is that prescribed fire is a planned event and wildfire is an unplanned event. Since a prescribed fire activity is a planned event, emissions impacts can be reduced by burning only when specific fuel conditions (specifically fuel moistures of the live and dead fuels) and meteorological conditions are present, thereby controlling the quantity and location of smoke, and the time spent in each combustion phase. The local air district takes into account the meteorological conditions, other emissions within the air basin and/or district, and the distribution of burns throughout the air basin on a daily basis when permitting specific prescribed burn projects within their jurisdiction.

Emissions can be further controlled through the utilization of emission reduction techniques that involve controlling the combustion process, these practices can be found in the National Wildfire Coordinating Group (NWCG) 2001 Smoke Management Guide and are discussed in the AP 42. According to the AP 42, the efficiency or inefficiency of the combustion process can directly affect the emissions produced; with the flaming phase being the most efficient creating minimal emissions and the smoldering phase being the least efficient creating substantially more emissions (EPA 1995). The Smoke Management Guide states that, “emission reduction techniques may reduce emissions from a given prescribed burn area by as much as about 60 percent to as little as virtually zero” (NWCG, 2001). Emission reduction techniques outlined by the NWCG 2001 Smoke Management Guide include reducing the burn area (burn concentrations, isolating fuels, mosaic burning), scheduling burning before new fuel appears (burning before fall litter, burning before green-up), increasing combustion efficiency (burning piles and windrows, backing fires, dry conditions, rapid mop-up, aerial ignition/mass ignition), and redistributing emissions (burn when dispersion is good, sharing the airshed, avoiding sensitive areas, burning smaller units, burning more frequently).

Wildfire events cannot be controlled in the same manner, as the variables affecting fire behavior are not controlled or managed, and resources are typically not available onsite when ignition occurs. However the amount of emissions from wildfire can be reduced overtime as fuel loads are reduced through vegetation treatment programs; the reduction of fuel loads and the increased resilience of vegetation to fire will not only reduce wildfire emissions over time but may also enhance ecosystem resiliency to other biotic and abiotic stressors (ex. pests, disease, drought, etc).

4.12.2 EFFECTS

4.12.2.1 Significance Criteria

For this analysis, significance criteria are based on the checklist presented in Appendix G of the State CEQA Guidelines. Based on the following, an air quality impact is considered significant if treatment activities for the VTP would do any of the following:

- Conflict with or obstruct implementation of the applicable air quality plan; or
- Violate any air quality standard or contribute substantially to an existing or projected air quality violation; or
- Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors); or
- Expose sensitive receptors to substantial pollutant concentrations; or
- Create objectionable odors affecting a substantial number of people.

Multiple air districts in California have published their own recommended CEQA guidance with specific quantitative thresholds for construction projects to determine whether emissions from individual projects would be considered significant in the context of CEQA. Appendix G states the significance criteria established by air districts may be relied upon to make air quality impact significance determinations. Due to the diversity of projects within the VTP, the construction quantitative thresholds will be utilized to analyze the impacts of the VTP for mechanical, manual, herbivory, and herbicide activities. Because the project would be implemented statewide, this analysis considers specific quantitative thresholds from each of the 35 local air districts in the state (see Table 4.12-4), and compares the maximum simultaneous project emissions that may occur in each local air district under the previously described activities against these thresholds.

Emissions from prescribed fire projects are fundamentally different from general construction related emissions and are treated through separate programs by local air districts as indicated above. The EPA indicates general support for treating prescribed fires as temporary activities in their Interim Policy on Air Quality on Wildland and Prescribed Fires. The EPA recognize that PM emissions from prescribed fire differ from those from most other sources because they occur infrequently at any specific location (once every 5 to 20 years) and are of short duration (approximately 1-2 days) when they do occur (EPA, 1998). The ARB refers to this analysis in the development of the amendments to the agricultural burning requirements that incorporated the Smoke Management Program into their Title 17 regulations (ARB, 2000). Due to unique nature of prescribed fire activities and the distinction that the California Air Board makes for those emissions through its Smoke Management plan, the significant criteria for prescribed fire activities is based upon identical acreage being consume by wildfire.

For the following threshold analysis these differences in emissions for the air quality impacts from prescribed fire and construction related activities have been separated and are evaluated against different thresholds.

THRESHOLDS

To avoid understating the environmental effects of the VTP, this analysis conservatively estimates the spatially distribution of projects throughout the air basins and districts to see where the greatest potential concentration of simultaneous impacts could occur. This program level impact is then compared to the project level thresholds for pollutants of the local air districts. In this way, if the program level emissions can be judged to be less than the applicable thresholds, the emissions from any given project that falls under the scope of the VTP will also not create emissions above the applicable thresholds. The air district is considered the appropriate scale for analysis because they are the local jurisdiction having authority over any individual VTP project, and each local district considers emissions from adjacent districts in the air basin when setting emission thresholds. Project level mass emission thresholds recommended by air districts are typically expressed in units of pounds per day (lb/day) or TPY. The recommended mass emission thresholds for projects vary by air district and pollutant class (see Table 4.12-4).

Air Quality impacts from the VTP are divided into two kinds of emission producing categories: construction emissions and prescribed fire emissions. Construction emissions encompass the mechanical, manual, herbicide, and herbivory activities within the VTP, accounting for both worker trip and mechanical equipment emissions. Prescribed fire emissions include the emissions from the vegetation expected to be consumed by the prescribed fire, as well as the worker trip and mechanical equipment emissions associated with the activity. Construction emissions are subject to the daily CAAQS thresholds set forth for construction projects (Table 4.12-4) while prescribed fire emissions are managed by the local air districts through the burn authorization program and smoke management plans discussed above in section 4.12.1.1.3.

Impact number two in the analysis below proposes that a prescribed fire would have a significant impact on air quality if it would produce emissions greater than those produced by a wildfire burning the same acre. This threshold recognizes that the baseline disturbance for most vegetation types in California is fire and that periodic emissions are expected to occur naturally outside of VTP treatment. Section 4.1.3 has an extensive discussion about fire return intervals and general fire characteristics of each of the major vegetation types. Treatment through the VTP is expected to reduce the amount of those periodic emissions, and shift them to a time when the impacts on air quality can be controlled. Local air districts permit the number, acres and location of burning within their jurisdiction on a daily basis consistent with the local meteorological conditions and pollution levels on that day (ARB, 2000) with no set standard for maximum allowable emissions for any single project. With lack of guidance from the ARB or local districts about numerical thresholds from prescribed fire emissions to judge projects against, a reduction in emissions from the baseline condition of periodic disturbance by wildfire has been judged to be an acceptable threshold. Participation in the local air districts burn authorization program and adherence to the terms of the approved SMP will prevent projects that would exceed local air quality standards from occurring.

Thus for this analysis implementation of the vegetation treatment activities under the VTP would result in significant air quality impacts if projects were to:

1. Produce construction-generated or long-term regional CAPs or precursor emissions that would exceed the local air district daily significance thresholds during mechanical, manual, herbivory, and herbicide activities (Table 4.12-4);
2. Produce fire emissions that exceed those produced by a wildfire in the same vegetation type and of the same size as the prescribed fire project (Table 4.12-5);
3. Expose sensitive receptors to TAC emissions that would be estimated to increase of cancer contractions by 10 in 1 million people for the Maximally Exposed Individual (MEI) and/or a non-carcinogenic Hazard Index of 1 for the MEI; or
4. Create objectionable odors affecting a substantial number of people.
5. Expose sensitive receptors to fugitive dust emissions containing naturally occurring asbestos (NOA)

Table 4.12-4 Summary of California Ambient Air Quality Standards by Local Air District

			Daily Threshold of Signifance for CEQA Construction Projects (lbs/day)				
Air Basin	# of Cal Fire Units in District	AQMD or AQPD	Carbon Monoxide (CO)	Oxides of Nitrogen (NOx)	Volatile Organic Compounds (VOC)	Particulate Matter (PM10)	Particulate Matter (PM2.5)
North Coast	3	North Coast Unified	500	50	50	80	50
	1	Mendocino	125 TPY	54	54	82	54
	1	Northern Sonoma	125 TPY	54	54	82	54
Northeast Plateau	1	Siskiyou	500	50	50	80	50
	1	Modoc	500	50	50	80	50
	1	Lassen	500	50	50	80	50
Sacramento Valley	2	Shasta	*	137	137	137	*
	1	Tehama	*	137	137	137	*
	1	Glenn	*	137	137	137	*
	1	Butte	*	137	137	80	*
	1	Colusa					
	1	Feather River	*	25	25	80	*
	1	Yolo Solano	*	10 TPY	10 TPY	80	*
	1	Sacramento Metropolitan	*	85	*	*	*
Lake County	1	Lake	*	54	54	82	54
Mountain Counties	2	Northern Sierra	*	136	136	136	*
	1	Placer	*	82	82	82	*
	1	El Dorado	*	82	82	*	*
	1	Amador	*	82	82	384	*
	1	Calaveras	*	150	150	150	*
	1	Tuolumne	1,000	1,000	1,000	1,000	*
	1	Mariposa	*	136	136	136	*
San Francisco Bay	4	Bay Area	*	54	54	82	54
North Central Coast	2	Monterey Bay Unified	550	137	137	82	*
South Central Coast	1	San Luis Obispo	*	137	137	7	*
	1	Santa Barbara	*	240	240	80	*
	1	Ventura	*	25	25	*	*

Air Basin	# of Cal Fire Units in District	AQMD or AQPD	Carbon Monoxide (CO)	Oxides of Nitrogen (NOx)	Volatile Organic Compounds (VOC)	Particulate Matter (PM10)	Particulate Matter (PM2.5)
San Joaquin Valley	7	San Joaquin Valley Unified	100	10	*	15	15
Great Basin Valleys	2	Great Basin Unified	550	137	137	82	82
Mojave Desert	2	Mojave Desert	548	137	137	82	82
	1	Eastern Kern	*	137	137	*	*
	1	Antelope Valley	548	137	137	82	82
South Coast	5	South Coast	550	55	55	150	55
San Diego County	2	San Diego	550	250	137	100	*
Salton Sea	1	Imperial	550	55	55	150	*
	1	South Coast	550	55	55	150	55

Table 4.12-5 Daily Calculated Emission from Wildfire (assumes same acreage as treated by prescribed fire)

DAILY WILDFIRE EMISSIONS						
		tons/day				
			Particulate			
Formation	Acres/Day	Carbon Monoxide	PM 10	PM 2.5	VOC	NOx
TREE	433	2,224	234	210	158	33
SHRUB	433	599	78	67	64	14
GRASS	650	27	4	4	3	1
		2,850	316	281	224	48

Assumes same acres per day as prescribed fire, see Appendix H for further explantations. Calculator provided by Calfiornia Air Resources Board Coordination and Communication for Natually Ignited Fires (2011).

4.12.2.2 Impact Analysis Methods

This environmental impact analysis quantifies CAPs and precursor emissions associated with each type of vegetation treatment activity proposed under the VTP. The five vegetation treatment activities considered are: prescribed fire, mechanical, manual, prescribed herbivory, and herbicides. Please refer to Section 4.1.4 of this EIR for a full description of these treatment types.

The VTP includes a mix of vegetation treatment activities that would be implemented by CAL FIRE Units. Units are organized to address fire suppression over a geographic area, and are divided by region--North or South. CAL FIRE has 21 Units, each Unit consists of one or more counties. As described in Chapter 2, Project Description, the CAL FIRE Units would annually propose a set of vegetation treatment projects. Individual projects, once implemented, would be complete and would not result in on-going emissions; however, as a program with a planning horizon of 10 years, emissions from VTP activities would occur each year at the rates described in Chapter 2, Project Description (i.e., an estimated 60,000 acres per year for 10 years). For purposes of this analysis, the annual emissions from proposed VTP activities are considered to be construction emissions because each project is temporary and geographically discrete, with no ongoing daily emissions after project completion. Therefore, the construction emission thresholds described above are used to make significance determinations for the VTP air quality impacts.

The VTP recognizes a baseline condition of 30,000 acres per year that have in the past been subjected to vegetation treatment activities and proposes a 100 percent increase in the acres to be treated, i.e., to 60,000 acres per year (see Chapter 2 for details). This analysis estimates emissions associated with treatment activities on a daily basis, in lb/day. The VTP breaks down the proposed 60,000 treatable acres by number of projects for each treatment activity, as well as by vegetation type (i.e., tree dominated, grass dominated, shrub dominated).

Because treatment activities related to the VTP are not traditional land use projects with construction and operational phases, typical computer modeling tools are not relevant to generate daily emission rates. Instead, the California Emissions Estimator Model (CalEEMod) version 2013.2.2 was used to derive one-hour emission factors in lb/day for mechanical equipment employed in the treatment activities. Emissions from the combustion of vegetation by prescribed fire were estimated by using CONSUME version 3.0. This model is designed to assist resource managers to estimate fuel consumption and pollutant emissions from prescribed fire, and wildfire, in major fuel types throughout the U.S.

Because of the statewide nature of this Program EIR, the analysis quantifies emissions of an estimated, typical 260-acre project for each of the five treatment activities under the VTP, accounting for any changes to the activity based on vegetation type. Typical project size was derived by information presented in the Project Description (Chapter 2) and Section 4.1. Based on the proposed total acreage, total number of projects by vegetation type, and percentage breakdown by treatment activities, the number of proposed projects and acres by treatment activity and vegetation type were calculated (See Table 4.12-6). Emissions in this analysis were derived from the calculations in Table 4.12-6 as well as from the varying types of equipment used and the number of worker trips involved in a typical treatment activity project. Emissions attributed to prescribed fire projects are reported and analyzed separately (see Table 4.12-9), accounting for both the prescribed fire emissions and the equipment emissions associated with the activity. To conservatively estimate emissions from prescribed fire projects, all projects were modelled as broadcast burn. Pile and burning projects would have lower emissions than those estimated in this analysis.

Table 4.12-6 Summary of Proposed Projects and Acreage by Treatment Activity and Vegetation Type

Vegetation Type	Projects*	Acres*
Prescribed Fire (50%)		
Tree-Dominated	43	11,072
Shrub-Dominated	27	7,090
Grass-Dominated	46	11,838
Total Prescribed Fire	**115**	**30,000**
Mechanical (20%)		
Tree-Dominated	17	4,429
Shrub-Dominated	11	2,836
Grass-Dominated	18	4,735
Total Mechanical	**46**	**12,000**
Manual (10%)		
Tree-Dominated	9	2,214
Shrub-Dominated	5	1,418
Grass-Dominated	9	2,368
Total Manual	**23**	**6,000**
Prescribed Herbivory (10%)		
Tree-Dominated	9	2,214
Shrub-Dominated	5	1,418
Grass-Dominated	9	2,368
Total Herbivory	**23**	**6,000**
Herbicides (10%)		
Tree-Dominated	9	2,214
Shrub-Dominated	5	1,418
Grass-Dominated	9	2,368
Total Herbicides	**23**	**6,000**
Total	**231**	**60,000**

* Not all numbers will total correctly due to rounding

Emissions were calculated to estimate the maximum daily emissions that could be generated in an air district if each CAL FIRE Unit simultaneously operated no more than five VTP projects and no more than one prescribed fire per unit. These numbers were chosen based on the maximum capacity of CAL FIRE to perform multiple projects at the Unit level. This analysis conservatively represents the highest concentration of projects that may occur under the VTP in a single air basin concurrently to avoid the risk of understating environmental impacts. The actual emissions on any day from implementation of the VTP would likely be less than those presented below. For more details regarding the specific assumptions used in quantifying these emissions, see Appendix H.

TAC emissions associated with vegetation treatment activities are also discussed qualitatively based on the potential for projects to result in increased exposure to sensitive receptors (e.g., residences, schools) to high concentrations of TACs. This discussion addresses the types of TAC-emitting activities that could occur, such as diesel PM from treatment activity equipment, NOA-containing fugitive dust emissions from treatment activities near sensitive receptors, and the potential for long-term exposure.

The potential for vegetation treatment activities to create objectionable odors affecting a substantial number of people is also discussed qualitatively with a focus on the types of odor sources, their intensity, and their proximity to sensitive receptors.

4.12.2.3 Impacts Analysis

The following discussion analyzes the significance of the VTP's potential air quality impacts. The four impacts analyzed below for each analysis are based on significance criteria established in Appendix G of the State CEQA Guidelines as well as quantitative thresholds established by various air districts throughout the state. See the Impacts Analysis Methods section above for more detail regarding significance criteria and quantitative thresholds used in this analysis.

IMPACT 1 – TREATMENT ACTIVITY-GENERATED EMISSIONS OF CRITERIA AIR POLLUTANTS AND PRECURSORS: CONSTRUCTION LIKE EMISSIONS

Construction emissions related to vegetation treatment projects under the VTP would be generated by all five vegetation treatment activities. Emissions generated from vegetation treated by prescribed fire are calculated separately in Impact 2 below. Table 4.12-7 summarizes the daily emissions of CAPs and precursors per air district based on number of CAL FIRE Units within the air district. Emissions are represented in lb/day below based on the assumptions outlined above (no more than 5 simultaneous projects per Unit).

Table 4.12-7 Summary of Maximum Expected Emissions (lb/day) by Air District based on number of CAL FIRE Units within the District.

Number of Units in an Air District	Carbon Monoxide (CO)	Oxides of Nitrogen (NOx)	Reactive Organic Gasses (ROG)*	Particulate Matter (PM10)	Particulate Matter (PM2.5)
7	30.44	29.76	4.57	6.13	2.90
4	16.84	17.53	2.63	3.44	1.67
2	10.10	10.91	1.58	2.11	1.05
1	5.05	5.45	0.79	1.05	0.52

Construction Emissions for Mechanical Equipment excluding Prescribed Fire

Vegetation treatment activities associated with the VTP would include using mechanical equipment (both light and heavy-duty) that would generate short-term exhaust emissions of ROG, NO_X, PM_{10}, and $PM_{2.5}$. Exhaust emissions would also be generated by worker commute trips. Fugitive dust emissions, including emissions of PM_{10} and $PM_{2.5}$, vary as a function of soil silt content, soil moisture, wind speed, and the area of disturbance. Dust emissions would be generated by ground disturbance and vegetation clearing strategies (i.e., plowing land, using rotary mowers, tractors to clear land), and operation of equipment on unpaved roadways and over open land. The following subsections go into more detail regarding emissions for each of the specific vegetation treatment activities.

Mechanical Treatment Activities

Mechanical treatment activities would include using heavy equipment to clear the land of vegetation. Equipment needed for this activity would include chisel plows, rotary mowers, chipping equipment, and crawler-type tractors. This equipment is expected to result in max daily emissions statewide of approximately 7 lb/day of ROG, 33 lb/day of CO, 59 lb/day of NO_X, 8 lb/day of PM_{10}, and 5 lb/day of $PM_{2.5}$. Assuming most of the work is done mechanically, crew sizes are smaller for this activity, and daily worker trip emissions would result in max daily emissions statewide of approximately 1 lb/day of ROG, 19 lb/day of CO, 1.6 lb/day of NO_X, 3.2 lb/day of PM_{10}, and 1 lb/day of $PM_{2.5}$. While the equipment mix for this treatment activity would include the use of heavier exhaust emitting equipment, average project duration would be longer and would range from two weeks to two months.

Manual Treatment Activities

Because manual treatment activities require larger crew sizes and the use of handheld power tools, there would be very few daily emissions from equipment. Most of the emissions would come from the need for larger crews and more cars to get to and from the project site. Daily worker trip emissions would account for approximately 4 lb/day of ROG, 18 lb/day of CO, 23 lb/day of NO_X, 3 lb/day of PM_{10}, and 1 lb/day of $PM_{2.5}$.

Prescribed Herbivory Treatment Activities

Prescribed herbivory treatment activities would involve hauling livestock to a project site to graze the vegetation targeted for treatment. The main equipment involved with this activity would be the use of trucks to carry the livestock to and from the site. Crew sizes tend to be smaller with this activity, needing on average only three workers onsite for the typical two week project. As a result, equipment and worker trip daily emissions are combined in the estimate method and would account for no more 1 lb/day of ROG, 5 lb/day of CO, 1 lb/day of NO_X, 1 lb/day of PM_{10}, and 1 lb/day of $PM_{2.5}$.

Herbicide Treatment Activities

Herbicide treatment activities would not involve the use of any exhaust-emitting, motorized equipment, because all herbicides are applied manually using backpack and/or bottle applicators. As a result, only worker trip emissions are calculated. With an average crew size of 15 workers per project, worker trip daily emissions would account for 1 lb/day of ROG, 14 lb/day of CO, 1 lb/day of NO_X, 2 lb/day of PM_{10}, and 1 lb/day of $PM_{2.5}$.

Summary of all Treatment Activities

Vegetation treatment activities associated with the VTP would include using mechanical equipment (both light and heavy-duty) that would generate short-term exhaust emissions of ROG, NO_X, PM_{10}, and $PM_{2.5}$. Exhaust emissions would also be generated by worker commute trips. Fugitive dust emissions, including emissions of PM_{10} and $PM_{2.5}$, vary as a function of soil silt content, soil moisture, wind speed, and the area of disturbance. Dust emissions would be generated by ground disturbance and vegetation clearing strategies (i.e., plowing land, using rotary mowers, tractors to clear land), and operation of equipment on unpaved roadways and over open land.

The maximum expected daily program level construction emissions of CAPs and precursors associated with vegetation treatment activities are summarized in Table 4.12-7. Under the methodology described above, daily construction emissions of CAPs and precursors from the four treatment activities, considered together, would not exceed the Significance Thresholds identified in Table 4.12-3 for project level emissions of

ROG, PM_{10}, $PM_{2.5}$, or CO. The maximum expected daily program level emissions of NOx would exceed the significance threshold only in the San Joaquin Valley Unified Air Quality Management District. The maximum expected daily emissions of NO_X would be compliant within the identified standards set by all other Air Districts.

Table 4.12-8 Detailed Summary of Maximum Expected Emissions (lb/day) by Air District based on number of CAL FIRE Units within the District.

Number of Units in an Air District	Type of Emissions	Carbon Monoxide (CO)	Oxides of Nitrogen (NOx)	Reactive Organic Gasses (ROG)	Pariculate Matter (PM_{10})	Pariculate Matter ($PM_{2.5}$)
7	Equipment Emissions	13.35	20.90	3.33	2.90	1.88
	Worker Trip Emissions	17.09	8.86	1.24	3.23	1.02
	Total Emissions	30.44	29.76	4.57	6.13	2.90
4	Equipment Emissions	7.95	12.49	1.97	1.74	1.13
	Worker Trip Emissions	8.90	5.05	0.67	1.70	0.54
	Total Emissions	16.84	17.53	2.63	3.44	1.67
2	Equipment Emissions	5.09	8.14	1.21	1.15	0.75
	Worker Trip Emissions	5.02	2.77	0.37	0.96	0.30
	Total Emissions	10.10	10.91	1.58	2.11	1.05
1	Equipment Emissions	2.54	4.07	0.61	0.58	0.37
	Worker Trip Emissions	2.51	1.38	0.19	0.48	0.15
	Total Emissions	5.05	5.45	0.79	1.05	0.52

These projected emissions would be minimized through the implementation of a number of SPRs. First, each project proposed by an Operational Unit would be required to calculate the proposed CAP emissions associated with proposed treatment activities and compare those emission levels with the thresholds of the local Air District (AIR-2). If the proposed emissions would not exceed the thresholds of the local Air District, then no significant impacts would occur. If the emissions exceed the thresholds, then according to SPR AIR-2, the project's construction related emissions would be subject to additional SPRs AIR-5 through AIR-11, as described below. Exhaust emissions from off-road heavy duty equipment would be reduced with SPRs AIR-10 and AIR-11, where equipment would be properly maintained and equipment greater than 50 hp would be required to not exceed 16 hours of equipment hours per day. In addition, fugitive dust PM_{10} and $PM_{2.5}$ emissions would be limited by the dust control measures required by SPRs AIR-5, AIR-6, AIR-7, and AIR-8. Further mitigation for projects in the San Joaquin Valley Unified Air Quality Management District are included in Mitigation Measure AIR-1 below.

Mitigation Measure AIR-1

To achieve compliance with local air district emission thresholds in the San Joaquin Valley Unified Air Quality Management District, simultaneously projects within that air district will be constrained to appropriate number as not to exceed air quality standards. As a result, the Program shall implement the following:

- CAL FIRE shall not allow more than 7 simultaneous treatment activities to occur in the San Joaquin Valley Unified Air Quality Management District.

Significance after Mitigation

Implementation of SPRs and Mitigation Measure AIR-1 (MM AIR-1) would reduce CAP and precursor emissions below the threshold set by each local air district (see Table 4.12-4), therefore the impact to air quality from VTP emissions are considered to be less **than significant.**

IMPACT 2 – TREATMENT ACTIVITY-GENERATED EMISSIONS OF CRITERIA AIR POLLUTANTS AND PRECURSORS: PRESCRIBED FIRE EMISSIONS

Fire emissions within the VTP account for the most significant emission source of the entire VTP. Prescribed fire emissions are comprised of equipment emissions and emissions from vegetation combustion. Table 4.12-9 summarizes the daily emissions of CAPs and precursors for one prescribed fire burning in each air basin simultaneously.

Table 4.12-9 Summary of maximum daily emissions from prescribed fire activity (includes fire and equipment emissions).

DAILY PRESCRIBED FIRE EMISSIONS						
		lbs/day				
			Particulate			
Formation	Acres/Day	Carbon Monoxide	PM 10	PM 2.5	VOC*	NOx**
TREE	433	771,345	95,336	78,001	286,002	185
SHRUB	433	268,670	34,667	34,667	156,000	73
GRASS	650	39,015	13,003	2	4	35
		1,079,030	143,006	112,670	442,006	293
		tons/day				
			Particulate			
Formation	Acres/Day	Carbon Monoxide	PM 10	PM 2.5	VOC*	NOx**
TREE	433	386	48	39	143	0.09
SHRUB	433	134	17	17	78	0.04
GRASS	650	20	7	0	0	0.02
		540	72	56	221	0.15

*VOC includes ROG **NOx Calculated using the EPA standard, CONSUME does not provide NOx value.

Emissions from Construction Related Activities

Prescribed fire treatment activities would include both pile and broadcast burning. Under the VTP, half of the proposed 60,000 acres per year is expected to be treated using prescribed fire, with the majority of prescribed fire treatments occurring in grass-dominated vegetation. Mechanical equipment needed for this activity would include tractors, as well as a variety of torches depending on the vegetation type. Helicopters are expected to be used on occasion for aerial burns in shrub-dominated areas. This equipment is estimated to result in daily emissions of approximately 7 lb/day of ROG, 55 lb/day of CO, 54 lb/day of NO_X, 10 lb/day of PM_{10}, and 1 lb/day of $PM_{2.5}$. Taking into account the number of workers needed on average per project and assuming that workers would carpool and each car would take one round trip a day to the project site (25 miles each way), daily emissions for all prescribed fire treatment activities would be approximately 221 tons/day of VOC, 540 tons/day of CO, 0.15 tons/day of NO_X, 72 tons/day of PM_{10}, and 56 tons/day of $PM_{2.5}$.

Emissions from Combustion of Vegetation

Prescribed fire has four major pollutants CO, PM_{10}, $PM_{2.5}$, and VOCs. The amount of emission produced by a prescribed fire is dependent upon the level of combustion that is occurring during the event. Emissions for fire are estimated for each vegetation type, taking into account the average fuel loads of the vegetation, or how much of the fuel would be consumed in the fire under specific conditions. The EPA uses a weighted average that assumes for their emission calculations that 33 percent of the time will be spend in a flaming phase, while 67 percent of the time will be spent in a smoldering phase. The total emissions from a project can be greatly reduced by achieving a longer flaming period and shorter smoldering duration.

It is important to note that the VTP impacts to CAPs and precursors may actually be less than what is described above. As described in Chapter 2, the purpose of the VTP program is to modify wildland fire behavior to help reduce losses to life, property, and natural resources. The intended outcome is to have less frequent, smaller (i.e., less acres burned), and shorter duration wildfires over time. Therefore, the emissions from the prescribed burning activities would to some degree be replacing and potentially reducing total emissions from wildfires that would occur to a greater degree and duration without fuel modification. While there is not currently a direct correlation between implementation of a vegetation treatment project and a proportionate reduction in numbers of fires or acres burned, it is reasonable to acknowledge that while the VTP program would result in substantial emissions of CAPs as a result of prescribed fire, it would likely result in some reduction in the numbers of fires and/or burned acres from wildfires and, therefore, would avoid some emissions associated with those fires. The VTP also shifts those emissions to authorized burn days as determined by the local air district, limiting the air quality impacts of those emissions to sensitive receptors.

SPR AIR-12 requires a Smoke Management plan for projects that are 10 acres or are estimated to produce more than one ton of particulate matter. SPR AIR-3 requires that all burning be done in compliance with the local air district’s burn authorization program. These SPRs will limit the use of prescribed fire to those times and locations that the air basin can accommodate the pollutant load without exceeding air quality thresholds.

Daily emissions of CAPs and precursors associated with prescribed fire vegetation treatment activities are summarized in Table 4.12-9. Under the methodology described above, daily emissions of CAPs and precursors from the prescribed fire emissions, would not exceed the wildfire emissions set forth in Table 4.12-5 Daily Wildfire Emissions. As a result, this impact would be **less than significant**.

IMPACT 3 – EXPOSURE OF SENSITIVE RECEPTORS TO EXHAUST EMISSIONS OF TOXIC AIR CONTAMINANTS

Vegetation treatment activities that would be implemented under the VTP would not result in the operation of new stationary sources of TACs and would not include development of any new sensitive receptors (e.g., residences, schools, hospitals). Equipment emissions from certain treatment activities could, however, result in short-term exhaust emissions of diesel PM from on-site heavy-duty equipment such as plows, rotary mowers, and tractors used to clear land. Diesel PM has been identified as a TAC by ARB since 1998.

The dose to which receptors are exposed is the primary factor used to determine health risk (i.e., in this case, potential exposure to TAC emission levels that exceed SJVAPCD standards of increasing cancer contractions by 10 in 1 million people for the MEI and/or a noncarinogenic Hazard Index of 1 for the MEI). Dose is a function of the concentration of a substance in the environment and the duration of exposure to the substance. Dose is positively correlated with time, meaning that a longer exposure period would result in a higher exposure level for the exposed individual. Thus, the risks estimated for an exposed individual are higher if a fixed exposure occurs over a longer period. According to the Office of Environmental Health Hazard Assessment (OEHHA), Health Risk Assessments, which determine the exposure of sensitive receptors to TAC emissions, should be based on a 70-year exposure period; however, such assessments should be limited to the duration of exposure (2001). The use of motorized equipment for vegetation treatment activities under this VTP would be infrequent and temporary, meaning exhaust emissions from this equipment would dissipate with increasing distance from the source and exposure time would be limited (Zhu et al. 2002). Also, because of the nature of this program and the likelihood that treatment activities would occur in area that are less populated, rural, or undeveloped, it is not anticipated that mechanical equipment would operate at the same location for any extended length of time. Moreover, several of the SPRs would limit exposure of sensitive receptors to emissions of TACs from construction-related activities. SPR AIR-10 would limit operation time of large diesel or gasoline-powered activity equipment to 16 equipment-hours per day. SPR AIR-11 would ensure that all diesel and gasoline-powered equipment is properly maintained to comply with all state and federal emissions requirements. SPRs NSE-4 would require construction staging areas and construction activities to be located away from any nearby sensitive receptors, and SPR NSE-5 would reduce idling time of all motorized equipment to five minutes. For these reasons, treatment activity-related emissions of TACs would not expose sensitive receptors to substantial emissions of TACs and would not be expected to increase cancer contractions by 10 in 1 million people for the MEI and/or a non-carinogenic Hazard Index of 1 for the ME. As a result, this impact would be **less than significant**.

IMPACT 4 – EXPOSURE OF SENSITIVE RECEPTORS TO ODORS

Vegetation treatment activities could include the temporary generation of objectionable odors associated with diesel equipment exhaust. However, multiple SPRs would limit exposure of sensitive receptors to excessive levels of odorous emissions generated by vegetation treatment-related activities. SPR AIR-10 would limit operation time of large diesel or gasoline-powered construction equipment to 16 equipment-hours per day. SPR AIR-11 would also ensure that all diesel and gasoline-powered equipment are properly maintained to comply with all state and federal emissions requirements. SPR

NSE-4 would require all heavy equipment and equipment staging areas to be located as far as possible from nearby sensitive receptors. Also, SPR NSE-5 would reduce idling time of equipment or trucks to five minutes. Further, treatment activities would occur in areas that are generally less populated, rural, or undeveloped. Because every treatment type project approved under this VTP would be subject to the above SPRs, all treatment activity-related odor sources would be sufficiently dispersed and would not be expected to adversely affect a substantial number of off-site receptors.

Furthermore, treatment activities approved under the VTP would not include the development of any new sensitive land uses or of any new major odor sources (e.g., wastewater treatment plant, landfill). Therefore, vegetation treatment activities would not result in exposure of a substantial number of people to objectionable odors. As a result, this would impact would be **less than significant**.

IMPACT 5 - EXPOSURE OF SENSITIVE RECEPTORS TO FUGITIVE DUST EMISSIONS CONTAINING NATURALLY OCCURRING ASBESTOS

As stated in the setting above, some areas of California contain serpentinite or other ultramafic rock and soil that could potentially contain NOA. These types of rock and soil contain thin veins of asbestos fibers that can become airborne when disturbed. Thus, vegetation treatment activities approved through this VTP could result in dust-generating activities in areas where NOA-containing materials are exposed at the surface, if they occur in areas where NOA is present. Re-entrainment of NOA-containing dust may result from ground disturbing activities during treatment activities, including vehicle travel on unpaved surfaces, plowing, mowing, and tractor use.

The CGS, formerly the California Department of Conservation Division of Mines and Geology published *A General Location Guide for Ultramafic Rocks in California – Areas More Likely to Contain Naturally Occurring Asbestos (*Churchill and Hill 2000*).* SPR AIR-9 requires that before any ground disturbing treatment activities take place, this publication, or any other recommendation by CGS at the time, be used to determine the risk for NOA at the treatment site. If, it is determined that NOA could be present at the project site, then SPR AIR-9 requires that an Asbestos Dust Control Plan be developed and implemented. The Asbestos Dust Control Plan would comply with Section 93105 of the California Health and Safety Code and would ensure appropriate controls are in place to reduce exposure to airborne NOA during vegetation treatment activities. Because all ground disturbing treatment activities would be subject to SPR AIR-9, the potential for sensitive receptors to be exposed to NOA would be minimized. As a result, this impact would be **less than significant**.

4.12.2.4 **Level of significance after mitigation**

Impacts from TAC emissions, NOA-containing fugitive dust emissions, and objectionable odors associated with the proposed vegetation treatment activities would be less than significant, so no mitigation would be required.

Construction emission would be less than significant in all air districts except the San Joaquin through the implementation of AIR-1, AIR-2, AIR-5, AIR-6, AIR-7, AIR-8, AIR 10 and AIR-11. Through the implementation of MM AIR-1 construction emission would be reduced below individual air quality district's thresholds of significance in all air basins, as a result impact on air quality would be **less than significant after mitigation.**

Through implementation of AIR-1, AIR-3, AIR-4, and AIR-12 no prescribed fire activities will allow be allowed to exceed overall daily air quality thresholds. As a result impact on air quality from prescribed fire emissions would be **less than significant after mitigation**.

4.12.2.5 Air Quality Impact Analysis for Alternatives Considered

Four alternatives are considered under this analysis: Alternative A: WUI Only, Alternative B: WUI and Fuel Breaks, Alternative C: Projects Limited to Very High Fire Hazard Severity Zones, and Alternative D: Treatments that Minimize Potential Impacts to Air Quality. Alternative A proposes to limit fuel reduction projects to WUI areas only, while Alternative B would combine Alternative A with the option to create fuel breaks outside of the WUI. Under Alternative C, vegetation treatment activities would be focused in areas with the highest hazard classification of very high fire hazard severity zones (VHFHSZ). Alternative D reduces the numbers of acres treated under the VTP to 36,000, by reducing the numbers of acres treated through prescribed fire activities by 80 percent.

For Alternatives A, B, and C, the scale of the project remains the same as the proposed VTP at 60,000 treated acres per year for ten years, with the same vegetation treatment activities by vegetation type expected to occur. Geographically, the areas expected to be treated are similar to that proposed under the VTP. Because the nature of treatment activities are expected to be the same and the scale of the program is similar to that of the VTP, it is reasonable to assume that emissions and impacts associated with the VTP would be similar under each of these alternatives. As a result, impacts from CAP emissions, TAC emissions, NOA-containing fugitive dust emissions, and objectionable odors from vegetation treatment activities under Alternatives A, B and C would have a similar impact to the project and would be required to implement the same SPR's and mitigation measures. Overall, impacts would be similar to the project for Alternatives A, B, and C.

Under Alternative D, the scale of the project would be reduced compared to the proposed VTP, from 60,000 acres to 36,000 acres treated per year for ten years. The same vegetation treatment activities by vegetation type are expected to occur, but a reduction in acres treated through prescribed fire treatments is proposed to reduce air quality impacts. The reduction in acres treated through prescribed fires would be reduced by 80 percent, or 24,000 acres as compared to the proposed VTP. Geographically, the areas expected to be treated are similar to that proposed under the VTP.

Because CAP emissions related to prescribed fire treatment activities are the highest for all treatment activities, it is reasonable to assume that a reduction of 80 percent, or 24,000 acres, under this Alternative would reduce emissions significantly. Emissions related to other treatment activities would be expected to be the same as the proposed VTP because the same number of acres are expected to be treated using mechanical, manual, prescribed herbivory, and herbicides treatment activities. As a result, overall impacts related to CAPs would be expected to be reduced.

While the number of acres has been reduced under Alternative D, the same type of treatment activities are expected to occur in the same areas, therefore impacts from TAC emissions, NOA-containing fugitive dust emissions, and objectionable odors would have similar impacts as the proposed VTP project and would be required to implement the same SPR's. Overall, Alternative D would result in less air quality impacts compared to the Proposed Program.

4.12.3 MITIGATION AND STANDARD PROJECT REQUIREMENTS

The following SPRs and mitigation measure are designed to minimize the air pollutant emissions that could be associated with implementation of projects under the VTP. These SPRs are based on emissions reduction measures required or recommended by air districts in California. Modeling further determined the level of emissions-generating activity (e.g., number of vehicle trips per day) that could result in exceedance of the most conservative mass emission thresholds established by air districts in California.

AIR-1: The project shall comply with all local, state, and federal air quality regulations and ordinances. The local Air Pollution Control District (APCD) or Air Quality Management District (AQMD) will be contacted to determine local requirements.

AIR-2: Prior to approval of an CAL FIRE Unit project under the VTP, the project coordinator shall model the project's CAP emissions and compare the projected emissions levels to the thresholds identified by the local air district. If emissions levels exceed air district thresholds, consultation of the air district will occur.

AIR-3: Burning shall only be done in compliance with the burn authorization program of the local air district having jurisdiction over the project area. Authorization to burn shall be received no more than 48 hours prior to ignition. All projects greater than 10 acres or estimated to release more than 1 ton of particulate matter will prepare a smoke management plan. An example smoke management plan can be found in Appendix J.

AIR-4: Fire emissions and fire behavior shall be planned, predicted, and monitored in accordance with SPRs FBE-1, FBE-2, and FBE-3 with the goal of minimizing air pollutant emissions.

AIR-5: Dust control measures shall be implemented in accordance with SPRs Hyd-9 with the goal of minimizing fugitive dust emissions.

AIR-6: The speed of activity-related trucks, vehicles, and equipment traveling on unpaved areas shall be limited to 15 miles per hour (mph) to reduce fugitive dust emissions.

AIR-7: In areas where sufficient water supplies and access to water is available, all visible dust, silt, or mud tracked-out on to public paved roadways as a result of project treatment activities shall be removed at the conclusion of each work day, or a minimum of every 24 hours for continuous fire treatment activities.

AIR-8: Ground-disturbing treatment activities, including land clearing and bull dozer lines, shall be suspended when there is a visible dust transport.

AIR-9: Ground-disturbing treatment activities shall not be performed in areas identified as “moderately likely to contain naturally occurring asbestos (NOA)” according to maps and guidance published by the California Geological Survey (CGS), unless an Asbestos Dust Control Plan is prepared by the Operational Unit and approved by the air district(s) with jurisdiction over the project site. This determination would be based on a CGS publication titled *A General Location Guide for Ultramafic Rocks in California – Areas More Likely to Contain Naturally Occurring Asbestos* (Churchill and Hill 2000), or whatever more current guidance from CGS exists at the time the VTP project is evaluated. Any NOA-related guidance provided by the applicable local air district shall also be followed. If, it is determined that NOA could be present at the project site, then an Asbestos Dust Control Plan shall be prepared and implemented in accordance with Title 17 of the Public Health CA Code of Regulations of Section 93105.

AIR-10: Operation of large diesel- or gasoline-powered activity equipment (i.e., greater than 50 horsepower [hp]) shall not exceed 16 equipment-hours per day, where an equipment-hour is defined as one piece of equipment operating for one hour (daily CAPs, TACs, GHGs).

AIR-11: All diesel- and gasoline-powered equipment shall be properly maintained according to manufacturer's specifications, and in compliance with all state and federal emissions requirements. Maintenance records shall be available for verification.

AIR-12: In accordance with CCR Section 80160(b), all burn prescriptions shall require the submittal of a smoke management plan for all projects greater than 10 acres or are estimated to produce more than 1 ton of particulate matter. Example of a smoke management plan is in Appendix J.

Mitigation Measure AIR-1

To achieve compliance with local air district emission thresholds in the San Joaquin Valley Unified Air Quality Management District, simultaneously projects within that air district will be constrained to appropriate number as not to exceed air quality standards. As a result, the Program shall implement the following:

- CAL FIRE shall not allow more than 7 simultaneous treatment activities to occur in the San Joaquin Valley Unified Air Quality Management District.

4.13 AESTHETICS AND VISUAL RESOURCES

Aesthetics and Visual Resources has been broken up into three sections:

- **4.13.1 – Affected Environment**
    - The Affected Environment section discusses the resources that may be affected by the implementation of this proposed Program or its Alternatives.
- **4.13.2 – Effects**
    - The Effects section outlines the potential impacts of implementing the proposed Program and the Alternatives.
- **4.13.3 – Mitigations**
    - The Mitigation section provides the standard program requirements and project specific requirements that will reduce the likelihood of the proposed Program causing significant adverse impacts to aesthetic and visual resources.

4.13.1 AFFECTED ENVIRONMENT

This section discusses visual resources that could be affected by the proposed program. The visual resources analysis includes a discussion of viewsheds along highways that are designated or eligible for designation as scenic highways.

4.13.1.1 Background

Public and private lands contain many outstanding scenic landscapes. Visual resources in these landscapes consist of land, water, vegetation, wildlife, and other natural or manmade features visible on public lands. Vast areas of grassland, shrubland, canyon land, and mountain ranges on public lands provide scenic views to recreationists, visitors, adjacent landowners, and those just passing through. Roads, rivers, and trails on public lands pass through a variety of characteristic landscapes where natural attractions can be seen and where cultural modifications exist. Activities occurring on these lands, such as recreation, mining, timber harvesting, grazing, or road development, for example, have the potential to disturb the surface of the landscape and impact scenic and recreational values.

Visual importance of landscape elements is described with respect to their position relative to the viewer. Foreground elements are those features nearest to the viewer, and background elements are features at a great distance from the viewer. The middle ground of a view is intermediate between the foreground and background. Generally, for this analysis, the closer a resource is to the viewer, the more dominant and important it is to the viewer. Most of CAL FIRE's vegetation projects are not discernible at far distances.

The aesthetic effects of a project are more likely to be significant if they are highly visible to large numbers of the public over an extended period of time. Projects occurring within sight of major roads or within the WUI may impact the aesthetics for large numbers of people. Projects that are adjacent to rural residential properties may impact only small numbers of people but over a longer period of time. Projects in remote portions of the landscape, behind locked gates, or obscured by vegetation or ridgelines are less likely to significantly impact aesthetics. Changes to views that are seen by limited numbers of people or for only limited duration may be found to be less than significant.

The magnitude of change necessary to create a significant impact to aesthetics is greater in a disturbed or non-unique environment than in a pristine or rare environment. In wildland environments, vegetation manipulation is not generally presumed to have a significant adverse effect on aesthetics, whereas the same treatment in a managed state park may be significant.

Projects that are small in size or minimal in their physical changes to the environment are unlikely to cause a significant impact to aesthetics. Aesthetic changes associated with an individual project under the proposed Program (approximately 260 acres) may appear significant, but in the context of the entire bioregion may be relatively minor. Treatments which remove the primary vegetation layer such as mechanical shrub removal or prescribed fire in chaparral will have a much greater impact than those treatments only affecting the understory. Changes to aesthetics where the visual change is minor may be found to be less than significant.

Based on these factors, aesthetic effects on a programmatic scale were analyzed by assessing which treatments by themselves have an adverse visual effect and then determining how much of these treatments would occur in the viewshed of scenic highways. In order to calculate the potential treatment acreage in the viewshed, it was assumed that treatments are proportionally distributed between the viewshed of scenic byways and the remainder of the landscape in the bioregion.

4.13.1.2 Setting

The proposed program for vegetation treatment will include projects that occur on private and state lands throughout California. It is assumed that visual impacts will be most noticeable from roads and trails. The duration of the impact to visual or aesthetic resources will vary with both the treatment type and with the vegetation being treated. For example, because treatments in tree vegetation retain the natural character of that vegetation type, it will not have as great an impact on visual or aesthetic resources as treatments in grass or shrub types (Figure 4.13-1).

Figure 4.13-1 Example of the visual changes to an area following a Fuel Reduction project near Pollock Pines, California in 2003.

California's extensive road system consists of over 23,000 miles of interstates and highways (Table 4.13-1). Highways designated as scenic represent a small fraction of the total highway system, but should be considered most sensitive to visual impacts. California has over 2,000 miles of roadways that are officially designated as scenic (Caltrans, 2013). The California Scenic Highway Program was created by the California State Legislature in 1963 to preserve and protect scenic highway corridors from changes that would diminish the aesthetic value of lands adjacent to them. The scenic highway designation is based on how much of the natural landscape can be seen by travelers, the scenic quality of the landscape, and the extent to which development intrudes on travelers' enjoyment of the view (Caltrans, 1986). Table 4.13-2 provides a summary of the combined State and Federal miles of scenic roads by bioregion and an estimate of the viewshed area by vegetation type. The viewshed represents the visible area surrounding a scenic road, as interpreted from a Digital Elevation Model (DEM) and ignoring the influence of trees, buildings, or other possible obstructions. The viewshed analysis assumes a maximum viewing distance of two miles.

Table 4.13-1 Miles of Roads by Bioregion

Bioregion	Interstate	Highways	Total
Bay Area/Delta	1,706	1,416	3,123
Central Coast	433	1,152	1,586
Colorado Desert	527	805	1,332
Klamath/North Coast	547	1,693	2,240
Modoc	0	1,064	1,064
Mojave	768	1,279	2,047
Sacramento Valley	688	888	1,577
San Joaquin Valley	1,077	1,542	2,619
Sierra Nevada	346	2,558	2,904
South Coast	3,054	1,784	4,838
Total by Treatment	**9,146**	**14,182**	**23,328**

Table 4.13-2 Scenic Road Miles and Viewshed Acres by Vegetation Type

		Viewshed Acres		
Bioregion	**Scenic Road Miles**	**Tree**	**Shrub**	**Grass**
Bay Area/Delta	337	87,279	57,850	110,233
Central Coast	312	23,003	62,187	228,244
Colorado Desert	56	2,760	79,263	29
Klamath/North Coast	122	98,674	34,598	4,627
Modoc	260	181,755	18,266	1,891
Mojave	82	425	8,958	0
Sacramento Valley	0	0	0	0
San Joaquin Valley	83	17	0	10,312
Sierra Nevada	654	171,401	102,623	11,011
South Coast	190	16,598	23,114	4,673
Bioregion Totals	**2,097**	**581,910**	**386,860**	**371,020**
		Total Viewshed Acres		**1,339,790**

4.13.2 EFFECTS

This section will summarize the impacts to visual and aesthetic resources due to implementing either the Proposed Program or any of the Alternatives.

4.13.2.1 Significance Criteria

According to Appendix G of the CEQA Guidelines: the CEQA Initial Study Environmental Checklist, an aesthetic impact would be considered significant if the Program and Alternatives would:

a) Have a substantial adverse effect on a scenic vista,
b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway,
c) Substantially degrade the existing visual character or quality of the site and its surroundings,
d) Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area.

4.13.2.2 Determination Threshold

Visual effects from the program would be considered significant if the acreage of treatments causing adverse and long term effects, as determined through the analysis process, exceeds more than 10 percent of the scenic byways viewshed acreage within that bioregion in any 10-year period.

4.13.2.3 Direct Effects Common to all Bioregions From Implementing the Program/Alternatives

Potential visual effects are determined by the aesthetics of the landscape after a treatment is completed – i.e., what is the condition and configuration of the remaining natural vegetation. Tree vegetation types normally have treatments that primarily remove understory vegetation and reduce overall density. Because treatments in this type retain most of the existing overstory canopy and retain the natural character of the vegetation type, visual effects from all treatments in tree vegetation types are considered less than significant.

A shrub or grass area blackened from prescribed fire or mechanically disturbed by heavy equipment within the viewshed of a scenic highway is considered a potentially significant effect. This effect would be short-term (less than two years) in grass but longer-term in shrub. It could take up to ten years for shrub types to visually recover from these treatments. Herbicides would have a similar effect resulting in standing dead vegetation. Herbivory and manual treatments do not result in a fire scarred landscape or ground disturbance from heavy equipment that can be aesthetically unappealing; therefor, changes in visual quality are less than significant.

Even though in shrub and grass types the project level effects from prescribed fire, mechanical, and herbicides are potentially significant impacts, they do not cover enough of the viewshed in each bioregion to be considered significant at the programmatic level. Table 4.13-3 shows the proportion of the scenic highway viewshed potentially affected by grass or shrub treatments for each bioregion. It is only in the Colorado Desert where over 10 percent of the total program acres in that bioregion may be shrub or grass treated acres in a viewshed (Table 4.13-3). For this bioregion, project planning should take into account the location and treatment activity choices to consider cumulative scenic viewshed impacts via the Project Scale Analysis.

Table 4.13-3 Percent of Program Acres That Are Affected Scenic Viewshed Acres

Bioregion	Total Program Acres	Shrub and Grass Vegetation Acres in Viewshed	Percent of Scenic Viewshed Affected
Bay Area/Delta	2,388,144	168,084	7%
Central Coast	3,226,555	290,430	9%
Colorado Desert	438,715	79,291	18%
Klamath/North Coast	6,094,961	39,225	1%
Modoc	2,875,754	20,157	1%
Mojave	1,088,200	8,958	1%
Sacramento Valley	906,209	0	0%
San Joaquin Valley	747,189	10,312	1%
Sierra Nevada	5,046,500	113,634	2%
South Coast	2,066,144	27,787	1%
Totals	**24,878,369**	**757,880**	**3%**

Given that for the majority of bioregions, shrub and grass viewshed acres are less than 2 percent of the overall potentially treated acres, it is unlikely that the acreage of prescribed fire, mechanical, or herbicides treatments causing aesthetic effects would exceed more than 10 percent of the scenic byways viewshed acreage within any bioregion in any 10-year period. The rest of the bioregions have too small a proportion of their scenic viewshed treated to cause a significant adverse effect at the program scale either annually or within a decade. The PSA may uncover project-specific aesthetic and visual impacts that are not detected at the scale of the bioregion. With the application of the SPRs below and in Chapter 2.5 and any PSRs identified through the

PSA questions, effects to aesthetic and visual resources due to implementing the Proposed Program are likely to be **less than significant**.

As described in Section 4.12 Air Quality, prescribed fire could increase the amount of smoke in and adjacent to the treatment area. Smoke in the area could temporarily limit visibility and could modify views from scenic highways, state parks, and other visually important areas. For all prescribed burns, however, a burn plan will be required that includes a smoke management plan (SMP). The SMP will minimize public exposure to smoke generated by prescribed burns. Because only a small amount of smoke would remain in the treatment area for a short period during and after the prescribed burn, this impact is considered **less than significant** and no mitigation is required.

As described in Section 4.6 Archaeological, Cultural, and Historic Resources, protections are in place to reduce damage to scenic resources such as historic buildings via the use of CAL FIRE Archaeologists and the *Archaeological Review Procedures for CAL FIRE Projects* (Foster and Pollack, 2010). The impact to scenic resources of this type is considered **less than significant.**

Due to the activities described as part of the Proposed Program and Alternatives under this Program EIR, there would not be any new sources of substantial light or glare which would adversely affect day or nighttime views in the area. The land management activities described in this Program EIR would not involve the construction involving materials that may produce light or glare. This impact is considered **less than significant**.

The No Project alternative would apply to a landscape that is larger than the proposed Program, but due to costs, time constraints, and other limitations, it is anticipated that a smaller amount of acreage would actually be treated each year. Because of this, it is not likely to cause significant impacts to aesthetic and visual resources.

Alternative A would treat a smaller landscape as the Proposed Program, but treat the same number of acres. Because projects would only be allowed in the WUI, Alternative A would drastically reduce the number of prescribed fire and mechanical projects in grass or shrub, since any treated land would have to exist in the WUI area. Similarly, Alternative B would treat the same number of acres as the proposed Program across a smaller landscape, but only allow WUI and fuel break projects. The overlap of those project types, grass or shrub vegetation, a scenic viewshed and WUI area or fuel break need is unlikely to occur often, and Alternatives A and B would cause a less than significant impact to aesthetic and visual resources.

Alternative C would also treat a smaller landscape but the same number of acres as the Proposed Program. This Alternative would limit projects to VHFHSZ, which are determined by the existing fuels, topography, weather/climate, crown fire potential, and ember production and movement. Because this Alternative would exclusively focus projects in areas of high hazard, the required overlap of prescribed fire or mechanical treatment, grass or shrub vegetation, a scenic viewshed, and VHFHSZ is unlikely to occur often. Alternative C will have a less than significant impact to aesthetic and visual resources.

Alternative D would treat the same landscape as the Proposed Program but treat a smaller amount of acres due to the reduction of the use of prescribed fire. However, the reduction in prescribed fire is not replaced entirely by increases in other treatment methods, and so the overall visual impacts are less. Because of the overall smaller treatment area proposed, and with the mitigation measures proposed below, Alternative D would not result in significant aesthetic and visual resources impacts.

4.13.2.4 Similar Effects Described Elsewhere

Impacts to recreational resources are described in Section 4.8 and impacts to archaeological, cultural, and historic resources are described in Section 4.6.

4.13.3 MITIGATION AND STANDARD PROJECT REQUIREMENTS

Under this analysis there are no mitigations. However, several Standard Project Requirements have been developed as part of the project design. SPRs are required for shrublands in San Diego, Imperial, Riverside, Orange, Los Angeles, Ventura, Santa Barbara, and San Bernardino counties.

AES-1: See **BIO-5** for shrublands in San Diego, Imperial, Riverside, Orange, Los Angeles, Ventura, Santa Barbara, and San Bernardino counties.

BIO-5: Vegetation treatment projects that are not deemed necessary to protect critical infrastructure or forest health in San Diego, Imperial, Riverside, Orange, Los Angeles, Ventura, Santa Barbara, Kern, and San Bernardino counties shall:

- Be designed to prevent vegetation type conversion.
- Not take place in vegetation that has not reached the age of median fire return intervals.
- Not re-enter treatment areas for maintenance in an interval shorter than the median fire return interval outside of the wildland urban interface and excluding fuel break maintenance.
- Not take place in old-growth chaparral without consultation regarding the potential for significant impacts with the CDFW and the CNPS.
- Take into account the local aesthetics, wildlife, and recreation of the shrub-dominated subtype during the planning and implementation of the project.

- During the project planning phase provide a public workshop, or public notice in a newspaper that is circulated locally describing the proposed project during the project planning phase for projects outside of the WUI. The notification will be used to inform stakeholders and to solicit information on the potential for significant impacts during the project planning phase.

4.14 CLIMATE CHANGE/GREENHOUSE GAS

Vegetation treatment activities proposed by the VTP have the potential to generate greenhouse gas (GHG) emissions. This discussion presents a summary of applicable federal and state regulations, the current state of climate change science and GHG emissions sources in California, and a description of project-generated GHG emissions and their contribution to global climate change.

4.14.1 AFFECTED ENVIRONMENT

4.14.1.1 Regulatory Setting

4.14.1.1.1 Federal Plans, Policies, Regulations, and Laws

The U.S. Environmental Protection Agency (EPA) is the federal agency responsible for implementing the Clean Air Act (CAA). On April 2, 2007, the U.S. Supreme Court ruled that CO2 is an air pollutant as defined under the CAA, and that the EPA has the authority to regulate emissions of GHGs. In response to the mounting issue of climate change, EPA has taken the following actions to regulate, monitor, and potentially reduce GHG emissions.

PREVENTION OF SIGNIFICANT DETERIORATION AND TITLE V GREENHOUSE GAS TAILOR RULE

The CAA requires that new major stationary emissions sources and major modifications at existing stationary sources obtain an air pollution permit before commencing construction. On May 13, 2010, EPA issued the Prevention of Significant Deterioration and Title V Greenhouse Gas Tailor Rule (EPA 2011). This final rule sets thresholds for GHG emissions that define when permits under the New Source Review Prevention of Significant Deterioration (PSD) and Title V Operating Permit programs are required for new and existing industrial facilities.

PSD permitting requirements cover new construction projects that emit GHG emissions of at least 100,000 tons CO2e (90,718 MT) per year even if they do not exceed the permitting thresholds for any other pollutant. Modifications at existing facilities that increase GHG emissions by at least 75,000 tons (68,039 MT) per year will be subject to permitting requirements, even if they do not significantly increase emissions of any other pollutant. Title V Operating Permit requirements apply to sources based on their GHG emissions even if they would not apply based on emissions of any other pollutant. Facilities that emit at least 100,000 tons (90,718 MT) per year of CO2e will be subject to Title V permitting requirements.

As part of this rule, the U.S. EPA undertook another rulemaking on June 29, 2012. This action issued a final rule that continues to focus permitting on the largest emitters. The U.S. EPA did not revise the GHG permitting thresholds that were established by the GHG Tailoring Rule. Therefore, at this time, PSD and Title V permitting requirements are not applicable to additional, smaller sources of GHG emissions (EPA 2011).

MANDATORY GREENHOUSE GAS REPORTING RULE

On September 22, 2009, EPA issued a final rule for mandatory reporting of GHGs from large GHG emissions sources in the United States. In general, this national reporting requirement will provide EPA with accurate and timely GHG emissions data from facilities that emit 25,000 metric tons (MT) or more of CO2 per year. This publicly available data will allow the reporters to track their own emissions, compare them to similar facilities, and aid in identifying cost-effective opportunities to reduce emissions in the future. Reporting is at the facility level, except that certain suppliers of fossil fuels and industrial greenhouse gases along with vehicle and engine manufacturers will report at the corporate level. An estimated 85 percent of the total U.S. GHG emissions, from approximately 10,000 facilities, are covered by this final rule.

ENERGY POLICY AND CONSERVATION ACT

On September 15, 2009, EPA and the Department of Transportation’s National Highway Traffic Safety Administration (NHTSA) proposed a new national program that would reduce GHG emissions and improve fuel economy for all new cars and trucks sold in the United States. EPA proposed the first-ever national GHG emissions standards under the CAA, and NHTSA proposed Corporate Average Fuel Economy standards under the Energy Policy and Conservation Act. This proposed national program would allow automobile manufacturers to build a single light-duty national fleet that satisfies all requirements under both federal programs and the standards of California and other states.

ENDANGERMENT AND CAUSE OR CONTRIBUTE FINDINGS

On December 7, 2009, EPA adopted its Proposed Endangerment and Cause or Contribute Findings for Greenhouse Gases under the CAA (Endangerment Finding). The Endangerment Finding is based on Section 202(a) of the CAA, which states that the Administrator (of EPA) should regulate and develop standards for “emission[s] of air pollution from any class or classes of new motor vehicles or new motor vehicle engines, which in [its] judgment cause, or contribute to, air pollution that may reasonably be anticipated to endanger public health or welfare.” The rule addresses Section 202(a) in two distinct findings. The first addresses whether or not the concentrations of the six key GHGs (i.e., CO2, CH4, N2O, HFCs, PFCs, and SF6) in the atmosphere threaten the public health and welfare of current and future generations. The second addresses whether or not the combined emissions of GHGs from new motor vehicles and motor vehicle engines contribute to atmospheric concentrations of GHGs and, therefore, the threat of climate change.

The Administrator found that atmospheric concentrations of GHGs endanger the public health and welfare within the meaning of Section 202(a) of the CAA. The evidence supporting this finding consists of human activity resulting in “high atmospheric levels” of GHG emissions, that are very likely responsible for increases in average temperatures and other climatic changes. Furthermore, the observed and projected results of climate change (e.g., higher likelihood of heat waves, wild fires, droughts, sea-level rise, and higher intensity storms) are a threat to the public health and welfare. Therefore, GHGs were found to endanger the public health and welfare of current and future generations.

The Administrator also found that GHG emissions from new motor vehicles and motor vehicle engines are contributing to air pollution, which is endangering public health and welfare. EPA’s final findings respond to the 2007 U.S. Supreme Court decision that GHGs fit within the CAA definition of air pollutants. The findings do not in and of themselves impose any emission reduction requirements but rather allow EPA to finalize the GHG standards proposed earlier in 2009 for new light-duty vehicles as part of the joint rulemaking with the U.S. Department of Transportation.

TASK FORCE ON CLIMATE PREPAREDNESS AND RESILIENCE

Activities are already underway across the Federal Government to build adaptive capacity and increase resilience to climate change. These activities include efforts to improve understanding of climate science and impacts, to incorporate climate change considerations into policies and practices, and to strengthen technical support and capacity for adaptive decision making. Some efforts are large collaborative undertakings involving Federal and non-Federal partners while others are smaller and at the program-level. On November 1, 2013, President Obama signed an Executive Order that established a Task Force on Climate Preparedness and Resilience, made up of state, local, and tribal leaders across the country to advise the Administration on how the Federal Government can respond to the needs of communities nationwide that are dealing with the impacts of climate change (CEQ 2013).

4.14.1.1.2 State Plans, Policies, Regulations, and Laws

ARB coordinates and oversees State and local air pollution control programs in California and implements the California Clean Air Act (CCAA), which was adopted in 1988. Various statewide initiatives are aimed to reduce the State's contribution to GHG emissions.

EXECUTIVE ORDER S-3-05

In 2005, Governor Schwarzenegger signed Executive Order S-3-05, which proclaims that California is vulnerable to the impacts of climate change due to increased temperatures that could reduce the Sierra Nevada snowpack, exacerbate California's air quality problems, and potentially cause a rise in sea level. The executive order established total GHG emission targets to combat these concerns. Specifically, emissions are to be reduced to the 2000 level by 2010, the 1990 level by 2020, and to 80 percent below the 1990 level by 2050.

ASSEMBLY BILL 32: THE CALIFORNIA GLOBAL WARMING SOLUTIONS ACT OF 2006

In September 2006, Governor Arnold Schwarzenegger signed AB 32, the California Global Warming Solutions Act of 2006. AB 32 establishes regulatory, reporting, and market mechanisms to achieve quantifiable reductions in GHG emissions and a cap on statewide GHG emissions. It requires that statewide GHG emissions be reduced to 1990 levels by 2020. This reduction will be accomplished through an enforceable statewide cap on GHG emissions that began in 2012. To effectively implement the cap, AB 32 directs ARB to develop and implement regulations to reduce statewide GHG emissions from stationary sources.

AB 32 requires that ARB adopt a quantified cap on GHG emissions that represents 1990 emissions levels and to disclose how it arrived at the cap; institute a schedule to meet the emissions cap; and develop tracking, reporting, and enforcement mechanisms to ensure that the State achieves the reductions in GHG emissions necessary to meet the cap. AB 32 also includes guidance to institute emissions reductions in an economically efficient manner and conditions to ensure that businesses and consumers are not unfairly affected by the reductions.

AB 32 CLIMATE CHANGE SCOPING PLAN AND FIRST UPDATE

In December 2008, ARB adopted its Climate Change Scoping Plan, which contains the main strategies California will use to reduce GHGs. These strategies proposed a reduction of 169 MMT of CO2e, or approximately 28 percent from the State's projected 2020 emission level of 596 MMT of CO2e under a business-as-usual scenario. This equates to a 2020 emissions limit (or 1990 level) of 427 MMT of CO2e. These targets were approved by the Board in December 2007 (ARB 2008).

ARB's original 2020 business-as-usual projection was revised to 545 MMT of CO2e, to better take into account the economic downturn that occurred in 2008 (ARB 2011: p.1). In August 2011, the Scoping Plan was re-approved by ARB, and includes the Final Supplement to the Scoping Plan Functional Equivalent Document (FED), which further-examined various alternatives to Scoping Plan measures. The Scoping Plan also includes ARB-recommended GHG reductions for each emissions sector of the State's GHG inventory. ARB estimates the largest reductions in GHG emissions to be achieved by implementing the following measures and standards (ARB 2011: p.2-3):

- improved emissions standards for light-duty vehicles (estimated reductions of 26.1 MMT CO2e),
- the Low-Carbon Fuel Standard (15.0 MMT CO2e),
- energy efficiency measures in buildings and appliances (11.9 MMT CO2e), and
- a renewable portfolio and electricity standards for electricity production (23.4 MMT CO2e).

The First Update to the Climate Change Scoping Plan was approved by the ARB Board on May 22, 2014. This first update builds upon the initial Scoping Plan with new strategies and recommendations. It defines ARB's climate change priorities for the next five years, and also sets the groundwork to reach long-term goals set forth in Executive Order S-3-05. The update also highlights California's progress toward meeting the 2020 GHG emissions reduction target. Additionally, due to the fact that most national and international climate change organizations are moving to IPCC's Fourth Assessment Report, which updated the global warming potential of GHGs, especially methane and HFCs, ARB is proposing to update the number for the 2020 limit, from 427 to 431 MMT of CO2e, which is a one percent increase from the 427 MMT CO2e limit adopted by the Board in 2007 and outlined in the original Scoping Plan (ARB 2014b: p. 92).

The Scoping Plan and First Update both recognize the role of California's Natural and Working Lands (previously the Forest Sector) in meeting California's GHG reduction goals. These lands include both forests and rangelands and can act as both source and sink, with the levels of each fluctuating widely from year to year based on climatic and biotic factors that impact vegetative growth. The First Update recognizes that some actions taken to address ecosystem health may result in temporary, short-term reductions in sequestration but are necessary to maintain forest health and reduce losses due to wildfire. The goals set forward for these landscapes include prevented conversion to other uses and reducing vegetative fuels.

EXECUTIVE ORDER S-1-07

Executive Order S-1-07 was signed by Governor Schwarzenegger in 2007, and proclaims that the transportation sector is the main source of GHG emissions in California, at over 40 percent of statewide emissions. It establishes a goal that the carbon intensity of transportation fuels sold in California should be reduced by a minimum of 10 percent by 2020. This order also directed ARB to determine whether this Low Carbon Fuel Standard could be adopted as a discrete early action measure after meeting the mandates in AB 32. ARB adopted the Low Carbon Fuel Standard on April 23, 2009.

CAL FIRE GHG EMISSIONS REDUCTION STRATEGIES

CAL FIRE is a member of the Governor's Climate Action Team and has been implementing actions to reduce and mitigate GHG emissions. Activities include reforestation, forest conservation, forest health management, fuels management and biomass electricity generation, and urban forestry. CAL FIRE has coordinated with ARB during the preparation and update of the Scoping Plan to identify GHG reduction strategies for the Forestry Sector. Strategy descriptions, status, projected GHG reductions, costs, and co-benefits have been prepared and regularly reviewed for updating according to new models and information (CAT 2008).

Beginning in 2014, CAL FIRE has been allocating grants for GHG reduction projects through the Greenhouse Gas Reduction Fund (GGRF). Examples of projects financed by GGRF grants include forest health improvements, fuel hazard reduction, carbon sequestration projects, reforestation of degraded land, and conservation of forest land. The goal of the program is to help California forests continue to serve their carbon storage ecosystem function (CAL FIRE 2015).

SENATE BILL 1368

SB 1368 is the companion bill of AB 32 and was signed by Governor Schwarzenegger in September 2006. SB 1368 required the California Public Utilities Commission (CPUC) to establish a GHG performance standard for base load generation from investor-owned utilities by February 1, 2007. The California Energy Commission (CEC) was required by SB 1368 to establish a similar standard for local publicly owned utilities by June 30, 2007. These standards could not exceed the GHG emission rate from a base load combined-cycle natural gas–fired plant. The legislation further requires that all electricity provided to California, including imported electricity, must be generated from plants that meet the standards set by the CPUC and CEC.

SENATE BILL 1078 AND 107 AND EXECUTIVE ORDER S-14-08

SB 1078 (Chapter 516, Statutes of 2002) requires retail sellers of electricity, including investor-owned utilities and community choice aggregators, to provide at least 20 percent of their supply from renewable sources by 2017. SB 107 (Chapter 464, Statutes of 2006) changed the target date to 2010. In November 2008, Governor Schwarzenegger signed Executive Order S-14-08, which expands the State's Renewable Energy Standard to 33 percent renewable power by 2020.

SENATE BILL 97

As directed by SB 97, the Natural Resources Agency adopted amendments to the State CEQA Guidelines for GHG emissions on December 30, 2009. On February 16, 2010, the Office of Administrative Law approved the amendments, and filed them with the Secretary of State for inclusion in the California Code of Regulations. The amendments became effective on March 18, 2010, and require analysis of a projects impact on climate change and greenhouse gas for CEQA compliance.

SENATE BILL 375

SB 375, signed in September 2008, aligns regional transportation planning efforts, regional GHG emission reduction targets, and land use and housing allocation. SB 375 requires Metropolitan Planning Organizations (MPOs) to adopt a Sustainable Communities Strategy (SCS) or Alternative Planning Strategy (APS), which will prescribe land use allocation in that MPO's Regional Transportation Plan (RTP). ARB, in consultation with MPOs, will provide each affected region with reduction targets for

GHGs emitted by passenger cars and light trucks in the region for the years 2020 and 2035. These reduction targets will be updated every eight years, but can be updated every four years if advancements in emissions technologies affect the reduction strategies to achieve the targets. ARB is also charged with reviewing each MPO's SCS or APS for consistency with its assigned targets. If MPOs do not meet the GHG emission reduction targets, transportation projects would not be eligible for funding programmed after January 1, 2012.

EXECUTIVE ORDER S-13-08

Sea-level rise is a foreseeable indirect environmental impact associated with climate change, largely attributable to thermal expansion of the oceans and melting polar ice. As discussed above in the environmental setting (subheading "Adaptation to Climate Change"), sea-level rise presents impacts to California associated with coastal erosion, water supply, water quality, saline-sensitive species and habitat, land use compatibility, and flooding. Arnold Schwarzenegger signed Executive Order S-13-08 on November 14, 2008. This executive order directed the California Natural Resources Agency (CNRA) to develop the 2009 California Climate Adaptation Strategy (CNRA 2009)), which summarizes the best known science on climate change impacts in seven distinct sectors—public health, biodiversity and habitat, ocean and coastal resources, water management, agriculture, forestry, and transportation and energy infrastructure—and provides recommendations on how to manage against those threats. This executive order also directed OPR, in cooperation with the CNRA, to provide land use planning guidance related to sea-level rise and other climate change impacts by May 30, 2009, which is also provided in the 2009 California Climate Adaptation Strategy (CNRA 2009) and OPR continues to further refine land use planning guidance related to climate change impacts.

Executive Order S-13-08 also directed CNRA to convene an independent panel to complete the first California Sea-Level Rise Assessment Report. This report is to be completed no later than December 1, 2010. The report is intended to provide information on the following:

- Relative sea-level rise projections specific to California, taking into account issues such as coastal erosion rates, tidal impacts, El Niño and La Niña events, storm surge, and land subsidence rates;
- The range of uncertainty in selected sea-level rise projections;

- A synthesis of existing information on projected sea-level rise impacts to State infrastructure (such as roads, public facilities and beaches), natural areas, and coastal and marine ecosystems; and
- A discussion of future research needs regarding sea-level rise for California.

All State-funded construction projects in areas vulnerable to sea-level rise will consider a range of sea-level rise scenarios for the years 2050 and 2100. The scenarios should assess projected sea-level rise vulnerability and develop methods to reduce foreseeable incompatibilities (i.e., risks). However, this planning process is voluntary for projects that have filed a Notice of Preparation on or before November 14, 2008, are programmed for construction funding during the next five years, or are considered routine maintenance projects.

CALIFORNIA CLIMATE ADAPTATION STRATEGY

California's overall plan for climate adaptation is expressed in Safeguarding California (CNRA 2014). The plan provides policy guidance for state decision-makers, and is part of continuing efforts to reduce impacts and prepare for climate risks. This plan, which updates the 2009 California Climate Adaptation Strategy (CNRA 2009), highlights climate risks in nine sectors in California, discusses progress to date, and makes realistic sector-specific recommendations. One of the key sectors is forestry, where the emphasis is on preparing for increased wildfire hazards, including treatment of hazardous fuels, and improving forest management approaches in a changing climate (CNRA 2014).

CAL FIRE CLIMATE ADAPTATION STRATEGIES

Climate risk projections indicate a substantial increase in the risk of wildfires as a result of climate change. Forests are vulnerable to climate impacts, additional to increased fires, such as drought stress, invasive species, and changes in forest productivity. Efforts to implement forest adaptation are important to both ecosystem values (such as wildlife habitat, watersheds and streams, clean air and water, and soils) and human values (such as property, life safety, and wood products). Extensive research has been conducted by CAL FIRE, other state agencies, universities, and the federal government to understand forest- and rangeland-related climate risks and potential adaptation approaches. Identification and evaluation of CAL FIRE's adaptation strategies are included the Fire and Resource Assessment Program (FRAP). The 2010 FRAP assessment describes recommendations for climate threats and opportunities, including carbon sequestration, assessment of climate vulnerabilities, and protection of ecosystem functions of healthy forest and rangeland (FRAP 2010).

EXECUTIVE ORDER B-30-15

On April 29, 2015, Governor Brown signed Executive Order B-30-15 to establish a GHG reduction target of 40 percent below 1990 levels by 2030. This is set as an interim target for reaching the ultimate goal of reducing statewide GHG emissions to 80 percent below 1990 levels by 2050, as established by Executive Order S-3-05 (discussed above). Executive Order B-30-15 directs state agencies with jurisdiction over sources of GHG emissions to implement measures, within their statutory authority, to meet these targets. To monitor the progress towards these goals, the California Natural Resources Agency is directed to update the state's climate adaptation strategy, Safeguarding California, every three years.

4.14.1.2 Environmental Setting

GHG emissions have the potential to adversely affect the environment because such emissions contribute, on a cumulative basis, to global climate change. A discussion of cumulative impacts is the proper context for CEQA analysis, because although emissions of one single project would not result in global climate change, GHG emissions from multiple projects around the world could result in a cumulative impact with respect to global climate change. In turn, global climate change has the potential to result in rising sea levels, which can inundate low-lying areas; to affect rainfall and snowfall, leading to changes in water supply; to affect habitat, leading to adverse effects on biological resources; and to change the frequency and duration of droughts, which can affect wildfire hazards and forest health.

Cumulative impacts are the collective impacts of one or more past, present, and future projects, that, when combined, result in adverse changes to the environment. Although the impact of GHGs is inherently cumulative, it is different from typical cumulative impact analyses. GHG emissions are generated by anthropogenic (i.e., human-made) and biogenic (i.e., natural-process) sources throughout the world, and no project alone would reasonably contribute to a noticeable change to global climate change. However, legislation and executive orders on the subject of climate change in California have established a statewide context for and a process for developing an enforceable statewide cap on GHG emissions. Given the nature of environmental consequences from GHGs and global climate change, CEQA requires that lead agencies consider evaluating the cumulative impacts of GHGs, even relatively small (on a global basis) additions. Small contributions to this cumulative impact (from which significant effects are occurring and are expected to worsen over time) may be potentially considerable and significant. Therefore, this issue is presented at some depth, and focuses on the potential contribution to this global impact from the types of treatment activities and treatment types that could be implemented under the VTP.

4.14.1.2.1 Attributing Climate Change – Physical Science Basis

In the earth's atmosphere, certain gases classified as GHGs, play a critical role in determining the earth's surface temperature. Solar radiation enters the earth's atmosphere from space, with a portion of the radiation absorbed by the earth's surface, and a smaller portion of this radiation reflected back towards space. Radiation absorbed by the earth's surface is then emitted from the earth as low-frequency infrared radiation. The frequencies at which bodies emit radiation are proportional to temperature. The earth has a much lower temperature than the sun; therefore, the earth emits lower frequency radiation. Most solar radiation passes through GHGs; however, infrared radiation is absorbed by these gases. As a result, radiation that otherwise would have escaped back into space is instead "trapped," resulting in a warming of the atmosphere. This phenomenon, known as the greenhouse effect, is responsible for maintaining a habitable climate on Earth. Without the greenhouse effect, Earth would not be able to support life as we know it.

Prominent GHGs contributing to the greenhouse effect are carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF6). Human-caused emissions of these GHGs in excess of natural ambient concentrations are responsible for intensifying the greenhouse effect and have led to a trend of unnatural warming of the earth's climate, known as global climate change or global warming. Climate scientists agree that global warming trends and other shifts in the climate system observed over the past century are almost certainly attributed to human activities and are proceeding at a rate that is unprecedented when compared with climate change that human society has lived through to date (ARB 2014b).

Climate change is a global problem. Unlike criteria air pollutants and toxic air contaminants, GHGs are global pollutants that are pollutants of regional and local concern. Whereas pollutants with localized air quality effects have relatively short atmospheric lifetimes (about one day), GHGs have long atmospheric lifetimes (one year to several thousand years). GHGs persist in the atmosphere for long enough time periods to be dispersed around the globe. Although the exact lifetime of any particular GHG molecule is dependent on multiple variables and cannot be pinpointed, it is understood that more CO2 is emitted into the atmosphere than is sequestered by ocean uptake, vegetation, and other forms of sequestration. Of the total annual human-caused CO2 emissions, approximately 54 percent is sequestered through ocean uptake, uptake by northern hemisphere forest regrowth, and other terrestrial sinks within a year, whereas the remaining 46 percent of human-caused CO_2 emissions remains stored in the atmosphere (Seinfeld and Pandis 1998).

Similarly, impacts of GHGs are borne globally, as opposed to localized air quality effects of criteria air pollutants and toxic air contaminants. The quantity of GHGs that it takes to ultimately result in climate change is not precisely known; suffice it to say, the quantity is enormous and no single project alone would measurably contribute to a noticeable incremental change in the global average temperature, or to global, local, or micro climate. From the standpoint of CEQA, GHG impacts related to global climate change are inherently cumulative.

4.14.1.2.2 Attributing Climate Change – Greenhouse Gas Emission Sources

Emissions of GHGs contributing to global climate change are attributable in large part to human activities associated with transportation, industrial/manufacturing, utility, residential, commercial and agricultural emissions sectors (ARB 2014a).

Emissions of CO_2 are byproducts of fossil fuel combustion. CH_4, a highly potent GHG, results from off-gassing (the release of chemicals from nonmetallic substances under ambient or greater pressure conditions) is largely associated with agricultural practices and landfills. N_2O is also largely attributable to agricultural practices and soil management. CO_2 sinks, or reservoirs, include vegetation and the ocean, and absorb CO_2 through sequestration and dissolution, respectively, two of the most common processes of CO_2 sequestration.

CO_2 equivalent (CO_2e) is a measurement used to account for the fact that different GHGs have different potential to retain infrared radiation in the atmosphere and contribute to the greenhouse gas effect. This potential, known as the global warming potential of a GHG, is dependent on the lifetime, or persistence, of the gas molecule in the atmosphere. For example, as described in Appendix C, Calculation References, of the General Reporting Protocol of the California Climate Action Registry (CCAR), now called The Climate Registry (CCAR 2009), 1 ton of CH_4 has the same contribution to the greenhouse effect as approximately 21 tons of CO_2. Therefore, CH_4 is a much more potent GHG than CO_2. Expressing emissions in CO_2e takes the contributions of all GHG emissions to the greenhouse effect and converts them to a single unit equivalent to the effect that would occur if only CO_2 were being emitted.

4.14.1.2.3 State Greenhouse Gas Emission Inventory

The California Air Resource Board (ARB) is responsible for maintaining and updating California's GHG Inventory. The latest edition was completed in May 2014 and includes emissions estimates for the years 2000 to 2012. Based on the California GHG Inventory, California produced 459 million metric tons (MMT) of CO2e in 2012. This translates to a decrease of 1.7 percent from 2000 to 2012, with emissions 2012 increasing for the first time since 2007. This increase was driven largely by the increased natural gas-generation of in-state electricity due to the closure of the San Onofre Nuclear Generating Station as well as dry hydrological conditions in 2012 causing a drop in the in-state hydropower generation (ARB 2014b). While, emissions have decreased over the years, the transportation sector is still the largest emitter of GHGs in 2012, accounting for 37 percent of emissions. Industrial and electricity generation (in state and imports) are the next highest emitter, accounting for 22 percent and 21 percent, respectively (ARB 2014a). Aside from the electric power sector, which increased from the previous year, emissions from all other sectors have remained relatively constant since 2000 (ARB 2014b).

4.14.1.2.3.1 Wildfire versus Prescribed Fire Emissions

Similar to the discussion about emissions relating to Air Quality in Section 4.12, greenhouse gasses emissions are also effected by the combustion process. Revisiting AP 42, the efficiency or inefficiency of the combustion process can directly affect the emissions produced; with the flaming phase being the most efficient creating minimal emissions and the smoldering phase being the least efficient creating substantially more emissions. Fuel consumption during the smoldering phase is greatest when fuel moisture is low, and is minimized when fuel moistures are high as fires generally extinguish rapidly in these conditions. In general, the net emissions from prescribed fire are considered to be of relatively smaller quantity than those that would be produced by wildfire (EPA 1995). See Section 4.12.1.2.6 for further discussion.

4.14.2 EFFECTS

4.14.2.1 Significance Criteria

For this analysis, significance criteria are based on the checklist presented in Appendix G of the State CEQA Guidelines. Based on the following, GHGs or climate change impacts are considered significant if implementation of the VTP would do any of the following:

1) Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment; or
2) Conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of greenhouse gases; or
3) Result in a substantial increase in vulnerability of lands in CAL FIRE's responsibility area due to the effects of climate change.

An individual project typically does not generate enough GHG emissions by itself to significantly influence global climate. However, a project participates in this potential cumulative impact to the extent that its incremental contribution combined with the related contributions of other sources of GHGs, when taken together, result in global climate changes.

Only a few of the 35 air districts in California (i.e., including air quality management districts and air pollution control districts) have established thresholds of significance for GHG emissions generated by construction projects or stationary sites. The Sacramento Metropolitan Air Quality Management District (SMAQMD) has established quantitative thresholds for operational GHG emissions from projects in its jurisdiction regardless of the lead agency. The SMAQMD Board of Directors adopted GHG thresholds on October 23, 2014, via resolution AQMD2014-028, creating a screening-level threshold of 1,100 CO2e per year for land development and construction projects (SMAQMD 2014a). The South Coast Air Quality Management District (SCAQMD) adopted an interim GHG threshold of significance in 2008 for projects where SCAQMD is the lead agency (SCAQMD 2008). These thresholds were determined to be inappropriate for vegetation management projects in the WUI and wildlands that do not impact the underlying vegetative site productivity.

One of the primary challenges in establishing a reasonable threshold and determining impacts relate to the enactment of AB 32 and other GHG-reduction legislation described in the Regulatory Environment section above is the lack of statewide standards. As previously described, much of the legislation requires ARB and others to establish standards that relate to energy efficiency, carbon levels in fuels, stationary-source emissions, and regional transportation planning (i.e., SB 375). These standards are still being developed and have not yet been implemented. No standards have yet been established for hazardous fuel reduction projects that address wildfire risk reduction such as those proposed by the VTP.

While there are no statewide, adopted significance criteria applicable to GHG emissions, CEQA still requires a good faith evaluation of GHGs when determining a project's significant effects on the environment.

THRESHOLDS

Potential climate change and GHG impacts from the VTP come from three kinds of emission producing categories: equipment emissions, herbivore related emissions, and prescribed fire emissions. Construction emissions encompass the emissions from the mechanical and manual equipment necessary to conduct VTP projects as well as the worker trip emissions caused by transportation of work crews and equipment.

Emissions from herbivores occur as a result of their digestive and waste processes. Prescribed fire emissions are those expected from combustion of vegetation and comprise the vast majority of the GHG emissions expected to be caused by the VTP.

As discussed above, GHGs have the potential to mix and circulate worldwide making the spatial scale of a meaningful analysis difficult to define. Analyzing the project at the largest possible scale of accumulation, globally, would dilute the impacts of the project considering there was an estimated 35,419 Million Metric Tons (MMT) of CO_2e released to the atmosphere in 2013 (CDIAC, 2013). At the national level, the United States contributed over 15% of the worldwide total GHGs in 2013, approximately 6,673 MMT of CO_2e (EPA, 2013). As discussed above, there are plans and policies to reduce GHGs at the national level, but no thresholds have been established, and this was judged to also be too large of a scale for proper analysis. The State of California has a number of plans and policies in place designed to reduce GHG emissions, most notably the Global Warming Solutions Act of 2006 and the latest overall plan for climate adaptation, Safeguarding California (CNRA, 2014). Natural and working lands are expected to maintain a net sequestration of GHGs within these plans and policies, and reducing the risk of wildfire in these landscapes is consistently listed as a strategy to achieve this objective. No specific project-level threshold for GHG emissions from fuel reduction projects in California's WUI and wildlands has been adopted in these plans and policies. With the state responsible for 458 MMT of CO_2e in 2012 (California EPA, 2012), more than three orders of magnitude greater than emissions from the VTP, this scale may also dilute the program's impacts.

Prescribed fire treatments are the primary driver of GHG emission contributions from VTP projects. Wildland fire emissions are a primary contributor of GHGs from working and natural lands outside of the VTP. Total emissions from wildfires in California accounted for two-thirds of the 69 MMT of CO2e emitted between 2001 and 2010 by forests and wildland in California (Yang 2015), or roughly 4.5 MMT/year. It has been suggested that historic emissions from wildfires in California's forests, shrublands, and grasslands were substantially higher than current emissions (Stephens, et. al., 2007). Periodic disturbance by wildfire or other stochastic events (e.g. insect, disease, or wind) is a natural phenomenon experienced by all vegetation types in California as recognized by fire return intervals (see Section 4.1.3) and condition classes (see Section 4.1.4). McKinley et. al. (2011) describe the forest carbon cycle including periodic disturbance killing some or all of the trees and changing the balance between production and decomposition, but with the average forest carbon stocks being relatively stable over large spatial and temporal scales.

It is unknown whether any individual VTP project will be involved in a wildfire during the effective life of the treatment (see Section 4.1.5.7), but it is reasonable to assume that the collection of projects conducted at the scale of the program will modify wildland fire behavior by reducing the risk of ignition or the potential size and severity of wildland fire in the treated areas and adjacent landscape (see objectives, Section 2.1.4). Landscape level effects from fuel reduction treatment projects were identified in the Rodeo and Chedeski fires in Arizona in 2002 where fires burned less intense on the leeward side of treatment units (Finney et. al., 2005). Other studies have shown that treated forest stands may maintain more carbon in live trees post fire than untreated stands (Carlson et.al, 2012), indicating less intense fire behavior within the treated area. These stands may be more resilient to future fires as well (Stevens et. al., (2014). These studies indicate that VTP treatments can influence fire growth and intensity, and assist suppression efforts at the landscape scale. The threshold chosen for the analysis below is to compare the total VTP emissions to those emissions that would occur had those same treatment acres burned during a wildfire.

The appropriate time scale at which to evaluate the contribution of VTP GHG emissions presents another question in developing a meaningful threshold. When evaluating residual carbon in treated verse untreated stands that had been burned in a wildfire, Kent et. al. (2015) found that time since fire was an important factor influencing the results of their carbon measurements. Emissions will occur the year of project implementation in case of fire, herbivory, and equipment emissions, but benefits will be realized over time in terms of regrowth and reduction of fire risk to the project area and the surrounding landscape. A time period of one year or less will tend to capture immediate project emissions but will not account for the slow decomposition of dead plant material left on site, nor will it capture the benefit of future photosynthetic activity on site as the vegetation community recovers from the project disturbance. If evaluated over the time period of 100 years, an accepted estimate for the residence time of a CO_2 in the atmosphere (IPCC), all treatment emissions and benefits could be accounted for and the impacts from the project may not stand out against the natural carbon cycle fluctuations expected to occur over that time frame at the treatment area. Another potential time frame at which to evaluate GHG contributions from projects would be over the effective life of the treatment. This would tend to capture most of the emissions and benefits expected from the project. According to a recent study by the USFS in conjunction with the Spatial Informatics Group, “net GHG benefits were only realized when the probability of wildfire was high (15 year expected return interval), and only for the thin-from below treatments” (Saah et al 2012). The VTP does not include removal of commercial forest products during projects in tree dominated vegetation types and treatments will closely mimic the “thin from below” treatments in this study. Because the generally accepted time frame for evaluating project emissions is the year of project implementation with emissions generally reported as MT/year, this is also the time frame chosen for this analysis. This will conservatively estimate the VTPs impacts because the benefits of future vegetative growth as the site recovers and the reduction of wildfire risk to the treatment area and surrounding landscape is not taken into account.

VTP projects will occur in wildland urban interfaces and on landscapes recognized as natural and working lands in California's GHG reduction strategies. Projects will not alter the underlying land use or the productive capacity of treatment areas to support future photosynthetic activity. Additionally, treatments are expected to mimic the effects from fire and bring the project area back into condition class 1 (see Section 4.1.4), which would tend to reduce the potential impacts to site productivity should a future wildland fire occur. Fire disturbance regimes that have departed significantly from ecologically historical conditions can result in large-scale conversions of forests to shrublands and meadows (McKinley, et. al., 2011). In recognition of the important role these landscapes play in the sequestration of GHGs from the atmosphere both presently and in the future, a further threshold has been developed to prevent significant degradation of site productivity from VTP projects.

Thus for this analysis implementation of the vegetation treatment activities under the VTP would result in significant GHG and climate change related impacts if projects were to:

1. Produce emissions that are in excess of that which would periodically be produced from wildfire from those same acres (510,030 MT/year), or significantly degrade the productivity of the site by altering the species composition or degradation of the soil resources.
2. Result in a substantial increase in vulnerability of lands in CAL FIRE's responsibility area due to the effects of climate change.

4.14.2.2 Impact Analysis Methods

State CEQA Guidelines state that a lead agency should consider the extent that a project would increase or decrease emissions. This analysis quantifies the GHG emissions associated with each vegetation treatment activity proposed under the VTP.

The five main vegetation treatment activities considered are: prescribed fire, mechanical, manual, prescribed herbivory, and herbicides. The VTP includes a mix of vegetation treatment activities that would be implemented by CAL FIRE Operational Units. (Operational Units are organized to address fire suppression over a geographic area, and are divided by region--North or South. California has 21 Operational Units defined by county lines. Each unit consists of one to three counties. As described in the Chapter 2, Project Description, the Operational Units would annually propose a set of vegetation treatment projects. Individual projects, once implemented, would be complete and would not result in on-going emissions; however, as a program with a planning horizon of 10 years, emissions from VTP activities would occur each year at the rates described in Chapter 2, Project Description (i.e., an estimated 60,000 acres per year for 10 years).

Because of the statewide nature of this Program EIR, the analysis quantifies GHG emissions of an estimated, typical 260-acre project for each of the five treatment activities under the VTP, accounting for any changes to the activity based on vegetation type. Typical project size was derived by information presented in the Project Description (Chapter 2) and Section 4.1. Based on the proposed total acreage, total number of projects by vegetation type, and percentage breakdown by treatment activities, the number of proposed projects and acres by treatment activity and vegetation type were calculated. Emissions in this analysis were derived from the varying types of equipment used and the number of worker trips involved in a typical treatment activity project. In addition to quantifying any equipment related and worker trip information for each treatment activity, the analysis also includes fire emissions associated with broadcast burning for prescribed fire treatment activities. It also considers methane emissions (presented in CO2e) from enteric fermentation of the livestock used in prescribed herbivory treatment activities. Once average project emissions were found for each treatment activity and vegetation type, these emissions were multiplied by the total number of treatment activity projects estimated to occur each year under the VTP to quantify yearly GHG emissions. For more details regarding the specific assumptions used in quantifying the GHG emissions, see Appendix H.

The analysis also qualitatively discusses the potential impacts of global climate change on habitats throughout the state and how that would alter or change the implementation of vegetation treatment projects that could be approved under the VTP. The analysis qualitatively considers the potential long-term benefits of the vegetation treatment projects, but does not attempt to quantify benefits such as carbon sequestration, decreased wildfires as a result of this VTP, etc. Because the potential impacts of global climate change have only recently been realized, extensive data, commonly accepted thresholds of significance, and scientifically supported conclusions are not available. This discussion, therefore, draws from a range of studies that analyze global and regional patterns and trends that could have effects in California and describes the possible effects that could occur as a result of global climate change.

4.14.2.3 **Impacts Analysis**

The following discussion analyzes the significance of the VTP's potential GHG and climate change-related impacts. See the Impacts Analysis Methods section above for more detail regarding significance criteria used in this analysis.

IMPACT 1 – TREATMENT ACTIVITY GENERATED GHG EMISSIONS: EMISSIONS THAT ARE IN EXCESS OF WHAT WOULD BE PRODUCED BY WILDFIRE

GHG emissions related to vegetation treatment activities implemented under the VTP could be generated by the following five vegetation treatment activities: prescribed fire, mechanical, manual, prescribed herbivory, and herbicide treatments. Appendix H summarizes the GHG emissions per vegetation treatment activity. Emissions are represented in MT of CO2e per year. Emissions were calculated for each treatment activity under each of the three vegetation types. See Appendix H for more detailed calculations and the assumptions used in this analysis. Total emissions for all treatment activities associated with the VTP, would result in GHG emissions of 298,745 MT CO2e per year. The following subsections go into more detail regarding emissions for each of the specific vegetation treatment activities.

Prescribed Fire Treatment Activities

Prescribed fire treatment activities include both pile and broadcast burning. To be conservative, the GHG impacts of prescribed fire projects were analyzed by modelling all acres projected to be treated as broadcast burns. Under the VTP, half of the proposed 60,000 acres per year are expected to be treated using prescribed fire, with the majority of prescribed fire treatments occurring in shrub dominated vegetation. Taking into account that typical prescribed fire treatments would vary among vegetation type in terms of project duration, equipment needed, and crew size, the total GHG emissions for prescribed fire are estimated to be 298,070 MT CO2e per year. Mechanical equipment needed for this activity include tractors, as well as a variety of torches depending on the vegetation type. Helicopters are expected to be used on occasion for aerial burns in shrub-dominated areas. This equipment is estimated to result in GHG emissions of 63.36 MT of CO2e per year. Taking into account the number of workers needed on average per project, assuming that workers would likely carpool to the site, and assuming each car would generate one round trip per day to the project site (25 miles each way), GHG emissions from employee commute trips for all prescribed fire treatment activities would result in the generation of 15.7 MT of CO2e per year.

The GHG emissions resulting from combustion of vegetation during prescribed fire accounts for most of the emissions for this treatment activity with an estimated 298,149 MT of CO2e generated per year. Emissions for fire were estimated for each vegetation type, taking into account the average fuel loads of the vegetation and the quantity of fuel available for consumption by fire under specific conditions. Emission factors established by the EPA for Methane and emission factors from Development of Emissions Inventory Methods for Wildland Fire for CO2 were used in this analysis. Fire emissions for tree dominated and shrub dominated vegetation are generally higher than emissions from grasslands.

Mechanical Treatment Activities

Mechanical treatment activities include using heavy equipment to clear the land of vegetation. It is estimated that approximately 12,000 acres of the proposed 60,000 acres would be treated with mechanical equipment on an annual basis resulting in the generation of approximately 109 MT of CO2e per year. Equipment typically used for these activities include chisel plows, rotary mowers, chipping equipment, and crawler-type tractors. Crew sizes are typically small for mechanical treatment activities, limited to equipment operators and occasional supervisory personnel. Therefore, worker trip emissions are estimated to generate 2.5 MT of CO2e per year. Equipment emissions are higher than the other activities due to the equipment mix and because average projects tend to take longer to implement than prescribed fire treatment activities, generally ranging from two weeks to three months in duration.

Manual Treatment Activities

Manual treatment activities require larger crew sizes and the use of handheld power and non-power tools. It is estimated that approximately 10 percent of the acres treated under the VTP would use these manual methods. In general, GHG emissions of manual treatment activities are lower than mechanical and prescribed fire activities and are estimated to be 4 MT of CO2e per year under the VTP. Equipment emissions from power tools like chainsaws and power brush saws are estimated to be less than 1 MT of CO2e per year. Because crew sizes are larger for this activity and would require more cars to get to and from the project site, worker trip emissions are estimated to be 3.2 MT of CO2e per year.

Prescribed Herbivory Treatment Activities

Prescribed herbivory treatment activities would involve hauling livestock to a project site to browse or graze on vegetation targeted for treatment. The main equipment involved with this activity would be the use of trucks to carry the livestock to and from the site. In general, crew sizes tend to be smaller with this activity, needing on average only three workers onsite for the typical two week project. As a result equipment and worker trip emissions are combined in the estimate method and account for 31 MT of CO2e per year, this number is higher than any other activity because of the long project duration and the large trucks that carry livestock.

Emissions generated by the livestock from the methane released during enteric fermentation account for approximately 449 MT of CO2e per year and would be the largest source of emissions for this activity. Using a typical sheep herd size of 450 animals, methane emissions per head were calculated. Total GHG emissions for this activity would be approximately 480 MT of CO2e per year.

Herbicide Treatment Activities

Herbicide treatment activities do not involve the use of any GHG emitting motorized equipment as all herbicides are applied manually. The herbicides proposed for use by CAL FIRE are also not expected to generate any GHG emissions and are thus not accounted for in this calculation. As a result, only worker trip emissions are calculated. With an average crew size of 15 workers per project, worker trip emissions would account for 1.2 MT of CO2e per year.

Summary of all Treatment Activities

Total GHG emissions for all treatment activities proposed for the VTP total approximately 298,745 MT of CO2e per year. This number takes into account a variety of assumptions for the treatment activities and vegetation types proposed. Total equipment and worker trip emissions for all five treatment activities account for less than 0.01 percent of total program emissions, or an estimated 53.8 MT of CO2e per year. Emissions from off-road heavy duty equipment would be reduced with implementation of SPR CC-4 (and described in AIR-10 and AIR-11), where all equipment greater than 50 hp would be required to not exceed 16 hours of equipment hours a day and be required to be properly maintained. Livestock emissions account for roughly 0.1 percent of total program emissions. Prescribed fire emissions account for an estimated 99 percent of total program emissions with 298,745 MT of CO2e per year. SPRs CC-1 and FBE-1 would further reduce GHG emissions from prescribed fires by requiring burn intensities to be no more than necessary to accomplish the projects objectives. This number conservatively assumes that all acres are treated by broadcast burning and may be further reduced if some of these acres are piled and burned which reduces the amount of fuel on site available for ignition.

The VTP would create approximately 298,745 MT/year of CO2e, less than the 510,030 MT/year CO2e emissions created by a similar size wildfire burning. A number of SPRs are built into the VTP to ensure this standard is met on the project level. CC-1 requires pre-project modelling of the GHG emissions to minimize the project’s emissions. CC-3 requires implementation of AIR-3 and AIR-4, compliance with a smoke management plan and incorporation of project design elements that minimize emissions. FBE-1 requires an analysis of expected fire behavior and requires burn conditions to be such that fire intensity is the minimum necessary to achieve the projects objectives. SPR

HYD-3 and HYD-4 are expected to protect residual vegetation left on site by requiring buffer zones be established around watercourses and prevent direct ignition of fire in these zones. As a result, vegetation treatment activities associated with the VTP would not result in a considerable contribution to GHGs and would result in a **less than significant impact**.

Site productivity will be protected by implementation of SPRs designed to prevent the introduction of invasive species and limit soil disturbance from VTP projects. SPRs BIO-8 and BIO-9 would prevent invasive plants from being introduced to the site and degrading its productive capacity. HYD-3 protects vegetation around watercourses, and BIO-7 establishes vegetative buffer zones around plant and animal species of concern. CC-2 requires implementation of BIO-5 and BIO-6 to protect specific native vegetation potentially at risk of disturbance from VTP projects. BIO-5 requires that projects be designed to prevent type conversion and BIO-6 protects native oaks. GEO-1 limits activities that may occur on unstable soils, and HYD-7, HYD-8 and HYD-13 prevent soil compaction, protect bare soil from erosion, and disallow new road construction in VTP projects. HYD-15 protects the soil from impacts of burn piles by limiting them to no larger than ten feet by ten feet in size. As a result, vegetation treatment activities associated with the VTP would not result in a considerable contribution to GHGs and would result in a **less than significant impact**.

It is important to note that while the VTP would contribute to the level of GHG emissions; it may actually be less than described above. As described in Chapter 2, the purpose of the VTP program is to modify wildland fire behavior to help reduce losses to life, property, and natural resources. The intended outcome is to have less frequent, smaller (i.e., less acres burned), and shorter duration wildfires over time. Therefore, the emissions from the prescribed burning activities would to some degree be replacing and potentially reducing total emissions from wildfires that would occur to a greater degree and duration without fuel modification. While there is not a direct correlation between implementation of a vegetation treatment project and a proportionate reduction in numbers of fires or acres burned, it is reasonable to acknowledge that while the VTP program would result in emissions of GHGs as a result of prescribed fire, it would likely result in some reduction in the numbers of fires and/or burned acres from wildfires and, therefore, would avoid some emissions associated with those fires. The VTPs contribution to cumulative GHG emissions would not result in a considerable contribution to GHGs and would result in a **less than significant impact**.

IMPACT 2 – IMPACTS OF CLIMATE CHANGE ON VTP PROJECTS: INCREASE IN VULNERABILITY OF LANDS IN CAL FIRE'S RESPONSIBILITY AREA

As discussed previously in this section and in Chapter 2, human-induced increases in GHG concentrations in the atmosphere have led to global warming through the intensification of the greenhouse effect, and associated changes in local, regional, and global average climatic conditions. Although there is a strong scientific consensus that global climate change is occurring and is influenced by human activity, there is less certainty as to the timing, severity, and potential consequences of the climate phenomena. Scientists have identified several ways that global climate change could alter the physical environment in California. These include:

- increased average temperatures;
- modifications to the timing, amount, and form (rain vs. snow) of precipitation;
- changes in the timing and amount of runoff;
- reduced water supply;
- deterioration of water quality; and,
- elevated sea level.

These changes could translate into a variety of issues and concerns that could affect the lands in CAL FIRE's responsibility area. These include, but are not limited to:

- increased frequency and intensity of wildland fires as a result of altered weather patterns, precipitation patterns and temperatures (Randerson 2006);
- increase in uncharacteristically severe fires and fire hazards in California forests due to multiple years of drought along with overstocked vegetation conditions (Lenihan 2003);
- increased flammability of vegetation due to drought conditions, resulting in an active burning period that starts earlier and lasts longer than historical patterns (Westerling 2006);
- a shift from native to invasive species in chaparral shrubland ecosystems due to a too-frequent fire interval, thus increasing fire threat to a greater degree;
- increased air pollution and related effects on human health from severe wildland fires; and
- increased exposure of people and homes to wildland fires in WUI areas (Syphard, 2007).

Climate change is an issue of global scale and the impacts described above have the same likelihood of occurring whether or not any VTP projects are implemented. While GHG emissions from vegetation treatment activities under the VTP emit 298,745 MT CO2e per year (See Impact 1 for more information), there is also an emerging view among scientists that fire hazard mitigation through vegetation treatments or prescribed fire may play a beneficial role in long-term forest carbon sequestration, emissions reductions, and climate change mitigation (Hurteau and North 2010). John Battles, a professor at UC Berkeley, has stated, “Previous research [suggests] that a century of fire suppression has contributed to a potentially unsustainable buildup of vegetation” (Yang 2015). While changes to biophysical conditions have increased the threat of wildland fires in many locations, the exposure of people and homes to these threats has increased due to population growth and development in wildlands and WUI areas (Syphard et al., 2007). Where once only natural resources were threatened by wildland fire in these areas, threats now extend to life and property. There is a critical need for widespread restoration of lower fuel amounts across the West to address these issues.

By changing the composition of the landscape, the VTP allows CAL FIRE to better respond to the changing conditions associated with climate change, without conflicting with any applicable GHG reducing plan, policy, or regulation that has been adopted. In fact, as described in the Regulatory Settings section above, CAL FIRE is a member of the Governor’s Climate Action Team and is continuing to implement actions to reduce and mitigate GHG emissions. These actions include treatment activities and programs like the VTP. Additionally, through ARB’s Cap-and-Trade Program, CAL FIRE has been allocated grants for GHG reduction projects through the GGRF. The projects being implemented by CAL FIRE are helping to further mitigate the impacts of climate change and to reduce risk associated with catastrophic wildfires.

Furthermore, the adaptive nature of the program, with a variety of vegetation treatment activities and projects, also allows CAL FIRE to be more adaptive and responsive to wildland fires and would not make them more vulnerable to devastating losses. Additionally, through various Climate Change SPRs described in this section, CAL FIRE has protocols in place to further adhere to applicable plans, policies, and regulations and for managing these vegetation treatment activities with maximum feasible environmental protection. CC-1 specifically requires that prior to the approval of a VTP project; the project coordinator shall run a GHG-emissions model, such as FOFEM, to confirm that GHG emissions would be the minimum necessary to achieve risk reduction objectives. CC-2 requires that prescribed burning activities adhere to local air district regulations and only burn on authorized burn days (as described in SPR AIR-3). It also requires that a burn plan be prepared that is designed to initiate a low-intensity ground fire that would only consume the fuels needed to achieve risk reduction objectives (as described in FBE-1 and FBE-2).

In summary, implementation of vegetation treatment activities under the VTP would not result in an increase in vulnerability of lands in CAL FIRE’s responsibility area to the effects of climate change and would not conflict with any applicable plan, policy, or regulation that has been adopted for the purposes of reducing the emissions of greenhouse gases. Because implementation of vegetation treatment activities would allow CAL FIRE to better avoid, adapt to, or be resilient in the face of climate change-related impacts, this impact would be **less than significant**.

4.14.2.4 Impact Analysis for Alternatives Considered

Four alternatives are considered under this analysis: Alternative A: WUI Only, Alternative B: WUI and Fuel Breaks, Alternative C: Projects Limited to Very High Fire Hazard Severity Zones, and Alternative D: Treatments that Minimize Potential Impacts to Air Quality. Alternative A proposes to limit fuel reduction projects to WUI areas only, while Alternative B would combine Alternative A with the option to create fuel breaks outside of the WUI. Under Alternative C, vegetation treatment activities would be focused in areas with the highest hazard classification of very high fire hazard severity zones (VHFHSZ). Alternative D reduces the numbers of acres treated under the VTP to 36,000, by reducing the numbers of acres treated through prescribed fire activities by 80 percent.

For Alternatives A, B, and C, the scale of the project remains the same as the proposed VTP at 60,000 treated acres per year for ten years, with the same vegetation treatment activities by vegetation type expected to occur. Geographically, the areas expected to be treated are similar to that proposed under the VTP. Because the nature of treatment activities are expected to be the same and the scale of the program is similar to that of the VTP, it is reasonable to assume that emissions and impacts associated with the VTP would be similar under each of these alternatives. As a result, impacts on GHG emissions and global climate change from vegetation treatment activities under Alternatives A, B and C would have a similar impact to the project and would be required to implement the same SPR’s. Overall, impacts would be similar to the project for Alternatives A, B, and C.

Under Alternative D, the scale of the project would be reduced compared to the proposed VTP, from 60,000 acres to 36,000 acres treated per year for ten years. The same vegetation treatment activities by vegetation type are expected to occur, but a reduction in acres treated through prescribed fire treatments is proposed to reduce air quality impacts and indirectly greenhouse gas emissions as well. The reduction in acres treated through prescribed fires would be reduced by 80 percent, or 24,000 acres as compared to the proposed VTP. Geographically, the areas expected to be treated are similar to that proposed under the VTP.

Because GHG emissions related to prescribed fire treatment activities are the highest for all treatment activities, it is reasonable to assume that a reduction of 80 percent, or 24,000 acres, under this Alternative would reduce emissions substantially. Emissions related to other treatment activities would be expected to be the same as the proposed VTP because the same number of acres are expected to be treated using mechanical, manual, prescribed herbivory, and herbicides treatment activities. As a result, overall impacts related to GHGs and global climate change would be expected to be substantially reduced. Overall, Alternative D would result in less GHG and climate change impacts compared to the Proposed Program.

4.14.3 MITIGATION AND STANDARD PROJECT REQUIREMENTS

Under this analysis there are no mitigations. However, several Standard Project Requirements have been developed as part of the project design.

CC-1: Prior to approval of Operational Unit project under the VTP, the project coordinator shall run the FOFEM and other GHG-emissions models as appropriate to the treatment activity, to confirm that GHG emissions will be the minimum necessary to achieve risk reduction objectives.

CC-2: Carbon sequestration measures shall be implemented per SPRs BIO-5 and BIO-6 to reduce total carbon emissions resulting from the treatment activity.

CC-3: Treatment activity-related air pollutant emission control measures for prescribed burns shall be implemented in accordance with SPRs AIR-3 and AIR-4.

CC-4: Treatment activity-related air pollutant emission control measures for equipment operation hours, practices, and maintenance shall be implemented in accordance with SPRs AIR-11 and AIR-12.

Chapter 4 Summary Table

Impact Summary Analysis and Reference Locations.				
	Reference Location			
Environmental Review Resource Area	Resource impacts determined to be Significant	Significance Criteria	Threshold Criteria	Mitigation / SPR
Biological Resources	N	4-98	4-99	4-139, 5-27, 5-29-31, 5-40-45, 5-80
Geology, Hydrology, and Soils	N	4-187	4-187	4-203, 5-47, 5-50, 5-80
Hazardous Materials	N	4-216	4-216	4-225, 5-42, 5-55
Water Quality	N	4-252	4-252	4-203, 5-30, 5-42, 5-46, 5-5-54, 5-57, 5-80
Archeological, Cultural and Historic Resources	N	4-281	4-282	4-294, 5-60
Noise	N	4-297	4-298	4-304, 5-43, 5-62

Recreation	N	4-307	4-308	NM
Utilities and Energy	N	4-319	4-319	NM
Transportation and Traffic	N	4-323	4-323	4-326, 5-71, 5-75
Population, Employment, Housing, & Socio-economic Wellbeing	N	4-339	4-339	NM
Air Quality	N*	4-362	4-363	4-379, 5-75
Aesthetics and Visual Resources	N	4-384	4-385	NM
Climate Change	N	4-401	4-402	4-413, 5-80

* - No significance after mitigation is applied
NM - No mitigations were needed.